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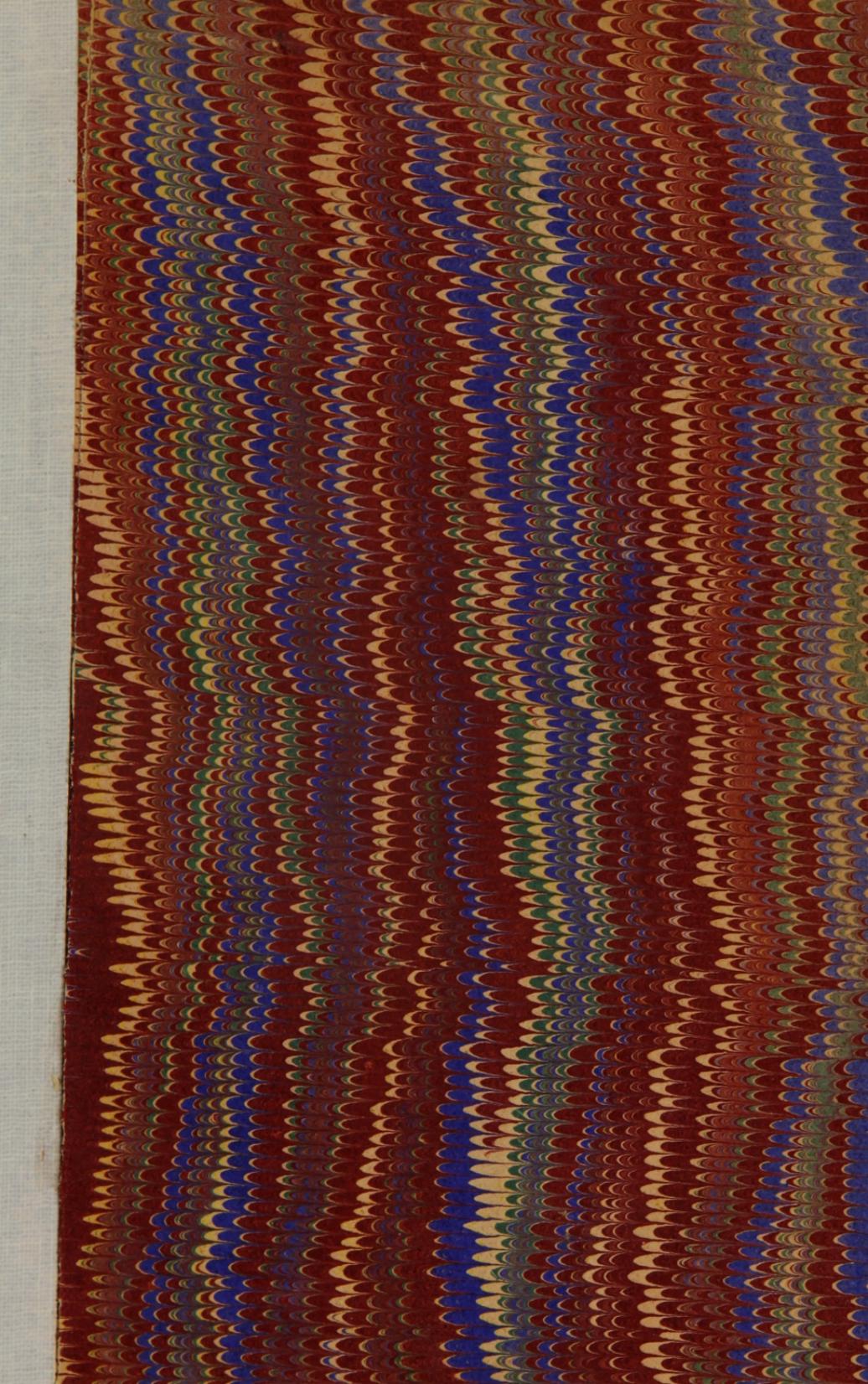
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The Use of Electricity in
Gynecological Practice.

BY

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REPRINT FROM VOLUME XI

Gynecological Transactions.

1886.

1 N of 1887, XT,



presented by the author

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1880

Dr. John S. Bellinger.
with the compliments
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THE USE OF ELECTRICITY IN GYNECOLOGICAL
PRACTICE.

BY GEORGE J. ENGELMANN, M. D.,
St. Louis, Mo.

For many years I have used electricity, galvanic and faradic, in gynecological practice, at times obtaining an excellent—nay, remarkable—result, so that I believed I had found in it a most efficient remedy; but then, again, it seemed ineffective, and I gave up the tedious efforts, until, after a long interval, some successful reports induced me again to resort to this mystic power in which I have always had a certain vague faith.

I was attracted by the occasional, but always accidental, results, and again stimulated to experiment, and invariably again discouraged by successive failures.

I firmly believed that we had a valuable and potent remedy in the electric forces, and a remarkable result, occasionally achieved, seemed to confirm this belief in a vague power, dormant or concealed, certainly veiled to us heretofore. The key to the secret I could nowhere find, neither in text-books nor in the writings of electro-therapeutists; but since it has been my good fortune to witness the work of Apostoli, whom I may truly call the apostle of gynecological electro-therapeutics, and since I have myself observed the positive results accomplished by the methodic use of electricity, a path seemed to open, and this previously almost mystic art at once developed into a tangible, definite science. During the past year I have persistently used the electric current in the treatment of pelvic disorders, and the decided success I have



since then attained, no longer accidental, but the result of method, has confirmed and convinced me of the value of this remedy, which, I am assured, when fully developed, will assume prominence as a therapeutic agent in gynecological practice.

But we must master this subtle fluid—the wonderful powers of which upon other fields are so well known to us—before it can with certainty and safety be classed among the reliable and standard weapons of our armamentarium, where it belongs. I have attempted to follow and develop the path staked out by Remak and pursued by Apostoli and Tripier, which opens to us the hidden wealth of a hitherto unknown territory. By following this path, I have come upon positive results, which are, unlike those formerly obtained, accessible to all, and for ever secured, by reason of methodic application, precise measurement, and accurate record.

I can not as yet completely cover the now but outlined field of gynecological electro-therapeutics. I shall give you the *results* I have myself achieved, and the *methods* by which they were accomplished, which is far more important than the recording of empirical results accidentally stumbled upon, however brilliant they may be.

The profession is too often treated to such remarkable reports: what good they have done, the present status of electro-therapeutics will show. The subject of gynecological electro-therapeutics, in all its details, as a complete whole, is one still to be developed; and this I believe feasible if a solid foundation is laid, which I am convinced we now have.

I shall first briefly survey the *present status* of electro-therapeutics with the *methods hitherto followed*, and, by comparison with the *method proposed*, the errors and fallacies will appear which have caused the lamentable state of affairs hitherto existing.

Finally, I will record the more striking of the cases treated in private practice and in my clinic, successful and

unsuccessful, at first empirical, but now open to explanation, record, and repetition ; and I trust that I shall succeed in convincing you that, by casting aside old ideas and prejudices, by beginning anew upon a scientific basis, we shall move upon a safer and clearer path. We have foundered upon reefs and sand-bars by following the dazzling but deceptive lights of brilliant empirical results, and we must now return to seek the harbor anew upon a more difficult and tortuous course, but a safe and certain one, by the light of science.

THE PRESENT STATUS OF ELECTRO-THERAPEUTICS AS ADOPTED
IN GYNECOLOGICAL PRACTICE.

I believe that I am safe in saying that electricity in medical practice has been an indefinite quantity, and can certainly not be classed among the established and reliable therapeutic agents. Gynecological text-books sometimes briefly refer to electricity in a general way, here and there a suggestion is made in a work on obstetrics, but even from the special works on electro-therapeutics, the gynecologist can gain but little ; certainly a definite form of treatment, so given as to be readily followed, is sought for in vain. The teachings of Robert Remak, the father of galvano-therapeutics, have been forgotten, ignored, or misapplied, and superseded by the purest empiricism.

Some enthusiasts, and even earnest investigators, proclaimed marvelous results, and it appeared for a moment as if the remedy for all evil had been found. Others vainly made the test, and their enthusiasm soon subsided ; as the observations could never be verified the remedy failed and was given up. Again, there is something mysterious in the hidden but almost endless power of the electric fluid which fascinates and attracts, making it a proper medium for the charlatan, and thus subjecting it to the contempt of the practitioner. Lauded as a wonderful curative agent by some, electricity is derided or denounced by others, and certainly looked upon

with indifference by the mass of the profession. WHY IS THIS?

CAUSES OF THE PRESENT STATUS OF ELECTRO-THERAPEUTICS.

Electricity as a therapeutic agent has heretofore been a most unreliable element; it has been used as we would any questionable, possibly potent remedy. Very mild doses, from which an appreciable effect could hardly be expected, have been given, mostly long continued; this has been to the proper use of electricity as the inunction of chinin is to the internal administration of effective doses of the alkaloid; some influence is exerted in time, but we can not with certainty expect a speedy and decided effect until we know precisely *what we are giving, in what quantity, and how administered.*

As we know that we must give ten grains of chinin three times a day, at least, to break a severe attack of malaria, so we must use a definite and effective dose of electricity to reduce a fibroid or dilate a narrowed canal, and we must know in what form to administer it; but this remedy was given without any idea of quantity or quality, with a vague idea of the method of application and the effect to be expected. Electric force sufficient, and more than enough, is generally on hand, but, by reason of the resistance offered by the clumsy electrodes in use, much of it—often the greater part of it—is lost in overcoming this unnecessary resistance; a great part of the medicine is spilled in the giving.

Workers in the various departments of medicine, who have sought to utilize this force, have naturally looked to text-books on electro-therapeutics, which are invariably from the hands of neurologists, for guidance; herein lies, in a great measure, the entanglement and misunderstanding now existing. Neurologists have found in the electric fluid a medium peculiarly appropriate for the treatment of nervous affections, and have naturally developed the science of electro-therapeutics in accordance with their needs, to cover a certain ground, and others seeking the aid of this agent

have just as naturally adopted the views and followed the methods of those who have devoted thought and study to the subject.

A false start was thus made. While the neurologist is dealing with a delicate tissue diffused throughout the entire body, in its centers excessively sensitive, nowhere to be exposed to the direct influence of the electric current, the gynecologist treats organs and tissues of a very different character, some directly within reach, mostly so constituted that they will not only suffer the direct action of the current, but demand it, if an effect is to be obtained.

The neurologist is obliged to go slowly, the current from a single cell being often sufficient to produce syncope, if applied to the nerve-centers, and to produce the desired therapeutic effect the use of weak currents must be long continued; the nerve-tissue to be affected often extends throughout the entire body; it forms a peculiar conductor for the electric fluid, and, if one electrode is properly placed, it is immaterial where the other is; the interpolar effect is sought, and, according to the result desired, the operator uses an ascending or descending current. Not so with the gynecologist; the tissues or morbid formations he attacks are localized and less sensitive, the direct polar influence of a strong current is called for, the effect of this current must be kept, as far as possible, within the part to be reached; and as action of the pole itself, the polar effect is the most important feature of this powerful remedy, the electrodes can not be placed at random; we can not use a few simple forms indiscriminately, as the neurologist does, but we must adapt them to the parts to which the effect must be confined; and, according to the object to be attained, we must differentiate between the use of one or the other pole; this is important, while ascending and descending currents are of no consequence whatever.

The wrong course had been thoughtlessly taken; the teachings of the electro-therapeutist have been followed, forgetful of the fact that it was the neurologist who spoke, and

that the same remedy must be given in a very different way to accomplish a widely differing purpose. As a tonic, chinin is given in grain or half-grain doses for weeks and months; as a febrifuge, in five- or ten-grain doses for a few days. Equally varying are the methods of applying the electric current—depending upon the object to be accomplished—and gynecologists have in vain attempted to derive benefit by following such as are useful to neurologists. The wrong course once taken, greater errors followed; and these I will demonstrate as we consider the methods hitherto pursued in gynecological electro-therapeutics.

ERRONEOUS PRINCIPLES UPON WHICH THE PRESENT SCIENCE OF ELECTRO-THERAPEUTICS IS BASED—FUNDAMENTAL ERRORS UNDERLYING GYNECOLOGICAL ELECTRO-THERAPEUTICS OF THE DAY.

I am obliged to call attention to the faulty practice which has regulated the use of electricity heretofore, that you may be convinced that it is ignorance and misapplication of the force¹—a false method, if method you may call it—which has caused the failure of electricity as a therapeutic agent in gynecology. That it is by no means due to inefficiency of the agent employed, will be shown by the results obtained by the method I shall propose.

The *greatest errors* have been: *a.* Insufficient knowledge of the forces employed; *b.* Reliance on the interpolar current and neglect of the powerful polar forces; *c.* The lack of localization and concentration; *d.* The total want of dosage or measurement; *e.* The determining of the force and limitation of the intensity of the current by the sensations of the patient.

To be more particular, I must condemn the method of application as almost universally pursued, and as it must continue to be practiced unless radical changes are made, on account of the following grievous faults:

¹ I refer to the methods of application which have been in vogue among practitioners in this country, not to the work of a few investigators, but to the practice of the profession at large.

1. The empirical use of electricity: the want of proper indications for the use of this powerful agent.
2. The powerful action of the pole direct was ignored, and the interpolar current, inferior as a remedial agent, has been the factor employed, while in its action it is to the polar action as the crude bark is to the alkaloid.
3. Indiscriminate use of the various forms and modifications of galvanic and faradic current.
4. Indiscriminate use of both poles.
5. Want of localization, and diffusion of current.
6. Lack of exactness, if not total absence of measure and dose.
7. Use of currents altogether too weak to be effective, and limiting their intensity by the pain inflicted.
8. Long duration of sittings, long continued.
9. Lack of proper electrodes and of instruments of precision.

None, I think, will deny that electricity has been used at random, empirically, as it suited the convenience of the operator; or more frequently, when all other means had failed, as a last resort, this mysterious power was tried, with a vague hope of benefit; I hardly believe that there is any morbid condition, in gynecological or obstetric practice, unless it be extra-uterine pregnancy, for which electricity has not been, with some unanimity, spoken of as a remedy.

The uncertainty or impotence of the agent as used is well shown by this lack of definite indications for its use. How lightly it is regarded by even able authorities we see by the statement made by Mundé, in his recent article ("Electricity as a Therapeutical Agent in Gynecology," *American Journal of Obstetrics*, December, 1885, page 1237), when he says: "That it requires no prolonged studies of the mysteries of electricity, and no complicated apparatus, to enable the practitioner, who is competent to correctly diagnose his patient's condition, to employ the electric current with safety, and in many cases with considerable benefit."

1. Indications for the use of electricity are of course given by all writers, but rarely definite, or by any two alike, certainly none have been proven and accepted by the profession.

2. The intensity of the polar current, heretofore neglected, is most effectively displayed by the active revulsion produced by the properly applied metallic pole of a faradic current, and the destruction of tissue by the negative metallic pole of a galvanic battery by chemical cauterization. (A chemical action, not to be confounded with the action of the galvano-cautery, produced by heat, the result of great quantity, in contra-distinction to the chemical cautery, of which alone we shall treat here, which is the result of high intensity; the first developed by size, the last by number of elements.) In gynecological electro-therapeutics we derive the most effective force from the pole direct, that of the current passing through the tissues from pole to pole being less potent and of very different character, but always to be considered and utilized, if possible. The old methods utilized altogether the current proper, the electric fluid in its passage through the tissues from pole to pole; hence I would call this the *interpolar* method, and the new departure here advocated the *polar* method, effective, definite, and localized, as compared with the vague efforts preceding.

3. How are we to expect definite results with the indiscriminate use of the various modifications of galvanic and faradic currents, differing so widely in their qualities, sometimes determining results diametrically opposed?

It was impossible to attain positive or uniform results when we had no definite knowledge of the means by which they were accomplished.

The meaning of the word electricity is as broad almost as that of medicine, comprising tonics, sedatives, stimulants, hemostatics, and yet the only distinction made was between the galvanic and faradic current; even this was in a few instances only upheld in practice, and though a vague idea ex-

isted of some difference between positive and negative poles, they were used indiscriminately ; the only accepted variation in the faradic current was in its strength, though this supple electric fluid possesses such varying qualities, which we may direct at will, so as to accomplish the most contradictory results ; with the galvanic current we can excite bleeding, or allay hemorrhage ; we can destroy tissue or stimulate healthy growth, contract or relax muscular fiber, and with the faradic current we can allay inflammation or excite it, we can soothe pain or excite the most active revulsion. We accomplish varying effects according to the length and thickness of the wire in the coil, according to the frequency of the interruptions, and the moisture or dryness of the electrodes ; still, there was no differentiation. Though the many instruments made all differ more or less in important elements of their construction, and the effect of the current varies greatly, no difference has been made in their therapeutic use.

One finds, to his disgust, that the faradic current aggravates the pain, and increases the inflammation, in a case of cellulitis, identical with one treated with the same current successfully by another ; he has used a different coil, a more or less moist electrode, not to speak of the varying strength and frequency of the current—all unconscious of the varying effect thus produced ; yet the operator was satisfied in his own mind that he had given electricity a fair trial, and that it did not accomplish what was claimed for it. Upon such judgment has the fate of this valuable remedy been determined.

I must again quote the recent article on "Electricity as a Therapeutical Agent in Gynecology," to show by the position of even the most advanced the reason why positive results could never be achieved. The author says : "I learn from practical electricians that it seems to make little difference whether the current ascends or descends, or whether the galvanic or faradic current is used, so far as the therapeutical result is concerned, if only the poles be applied in the proper spots and the current be not too strong."

While practice is based upon teachings such as these, progress is impossible; and until the various modifications of the galvanic and faradic current, and the varying results of different methods of use, are appreciated and understood, only empirical results can be expected.

4. Indiscriminate use of the poles.

A serious error, as well as a potent reason for the total absence of uniformity of result, is the indiscriminate use of the (+) positive and (-) negative poles, which differ so radically in the effect produced in the polar method, while indefinite ideas prevailed about the value of the ascending and descending current, a factor, however important in the treatment of nervous diseases, which is of no consequence whatever to the gynecologist, and has merely served to mislead. We will soon learn how important it is to use each pole in a definite place, for a definite purpose.

The metallic positive pole of the galvanic current being a hemostatic agent, this must be applied directly to the bleeding surface; it is not the current emanating from it, but the direct action of the pole itself; were the negative pole to be used, the flow would be increased. The importance of a correct and judicious use of the poles is evident, also the reason for the term *polar* as contrasted with the old *interpolar* method, which utilized the much less effective force of the current between the poles.

5. Want of localization and diffusion of current.

The efficiency of the treatment has been greatly diminished by distributing and weakening currents already insufficient; it is a natural sequence of the prevalence of neurological electro-therapeutics. While it is often immaterial upon what part of the body one or both of the poles are placed in the treatment of nervous affections, and while it may be of no import how far they are apart, as the nerve-tissue, like a network of electric wires distributed throughout the entire body, seems to attract the electric fluid and carry it over their course, the gynecologist seeks to affect a certain localized organ or part, and the farther the poles are apart, the more diffuse the

effect of the current; it is distributed over a greater part of the body, and each particle receives a share correspondingly smaller; if weak currents are used, the part attacked, like all others, receives but a minimum (the intensity of the current diminishing with the extent of tissue to be passed); if strong currents are used, healthy parts, which should be spared the infliction, receive an equal share, and the nervous system especially suffers by this diffuse use of the current, if strong.

Much of the inefficiency of the old method is due to this error. Instead of placing one pole directly against, if not into, the part to be reached, and the other upon the opposite side, confining the current as far as possible to this, we have been satisfied if one pole is in the vicinity, while the position of the other was immaterial.

6. Want of exactness if not total absence of measure.

It seems hardly necessary to point out how thoroughly empirical must be the use of any remedy without exact measure and dose, how dangerous if the remedy be a powerful one, how futile if of milder character. How is it possible to describe or direct treatment without such precision?

Measure is as necessary to the electro-therapeutist as scales and graduates are to the apothecary in the dispensing of alkaloïds and tinctures; even more injurious than the total want of measure is the use of one which is variable and incorrect; and this has been the bane, the drawback, which has clogged the progress of electro-therapeutics.

The intensity of the current has been measured by the number of cells used; this fails to be even approximate, it is misleading, and not a whit more definite than were I to compare the strength of the current by the kind of electrode used. Almost every battery has a different cell; but granted the cell be the same, it varies with the kind and freshness of the filling, with the moisture of atmosphere, skin and electrode, and, most of all, with the kind of electrode used. As an example, I will cite a case by which I demonstrated this

fact to a colleague: While applying the galvanic current to a fibroid complicated with perimetritis, I had attained an intensity of forty-eight milliampères, while using six cups of a dip battery with a flat, punk- and buckskin-covered electrode, six by nine inches large, over the mass of the tumor, and another, three by four inches, over the center of the peritoneal inflammation, while the patient experienced considerable burning; leaving everything in *statu quo*, I replaced the large electrode, six by nine, by a flat, round, sponge electrode, four inches in diameter, and the patient ceased to feel any sensation whatsoever from the current, which showed by the galvanometer an intensity of only four milliampères; this was with the same six cups; the mere changing of an electrode had reduced the intensity of the current from forty-eight to four milliampères; with the use of an additional four—ten cups—a slight burning was experienced, and the intensity increased to twelve milliampères. What possible guidance, then, can we derive from an element so easily influenced and so widely varied by each and every one of the many accessories? As Dr. Gray truly says, we might as well advise one to wear so many garments in the arctic region, and so many in the torrid zone, without reference to seasons, or to material and size of garments.

This elementary error, the absence of exactness of measure and dose characterizes all writings, text-books as well as special treatises, on the subject; hence the atmosphere of uncertainty, of vagueness, which pervades them; we can not follow them, we can not repeat the treatment—in fact, the same operator can not repeat precisely the same treatment which has proved successful before. The same battery varies constantly with the conditions above cited; hence the sporadic and isolated, though brilliant, results that every now and then arouse an interest in the subject, which again dies out because no one succeeds in convincing himself of the truth of the statement for want of exact qualification and dosing of the remedy prescribed.

7. Use of currents altogether too weak to be effective, and limiting their intensity by the pain inflicted.

The use of weak, ineffective currents is another result of the influence of the neurologist upon electro-therapeutics. He accomplishes the object desired by weak currents, and the gynecologist has again followed in his footsteps, although it does seem ridiculous to limit the dose of the remedy by the feelings of the patient; we might as well regulate the strength of a chinin mixture by its bitterness, and bid the patient stop as soon as this bitterness annoys him. Yet this has been the teaching not only in neurological but in gynecological electro-therapeutics. How, then, could we expect results, uniformity, or progress? Until we use, as in medicine, a certain dose, a certain intensity—that dose which will accomplish the object in the shortest space of time, without injury to the patient—we shall remain upon the present unsatisfactory standpoint.

This state of affairs is so well known that I need hardly cite proof, but I shall, nevertheless, quote the most recent expressions of a few of our American authorities: Dr. Freeman, of Brooklyn, says (*Journal of the American Medical Association*, July 24, 1886): "I can not too often repeat the advice—weak currents, and long intervals." Dr. Mundé (*American Journal of Obstetrics*, December, 1885) says: "When a constant current causes pain or even momentarily increases the pain, which it is intended to relieve, it should be reduced or discontinued"; and we are told that "the faradic current should be as strong and with as many interruptions as the patient will bear." The rule seems to be to use just as much as the patient can bear with comfort, totally regardless of the fact that sometimes less may suffice and sometimes much more may be needed to accomplish a certain effect, and that the pain experienced depends more upon kind and size of electrode than upon intensity of current. Nevertheless, this is the one rule which has guided the science of electro-therapeutics hitherto, and the only one which has been unanimously accepted.

Though it be true that we should not give pain, yet it is not the sensation of the patient, but the object to be accomplished, which must determine the intensity of the current to be used.

Now let us see what is meant by a weak current; few define it. Mundé says: "A larger number than twenty-four to thirty elements is never required, safe, or borne by the patient"; and Ranney, the only one who uses definite terms, says "that no patient will endure a current of over twenty milliampères through a high resistance, and very few will bear one over twelve milliampères"; and his is one of the latest and most progressive works; his statement is well borne out by the fact that most of the galvanometers made in this country do not indicate beyond twenty milliampères, and none over forty; even so those of Gaiffe, in Paris, until Apostoli called for an instrument indicating one hundred—an intensity hitherto unknown in medical electricity.

Tripier calls a current of three to five milliampères feeble, one of from eight to fifteen milliampères of medium intensity, and over twenty, strong. This simple statement will suffice to show that the currents hitherto used have indeed been weak currents, as compared with those which I have used, and which I deem necessary for effective and successful treatment.

8. Long duration of sittings, long continued.

Not only has this use of weak currents rendered the agent ineffective, but it has placed it beyond the reach of the busy practitioner, as long sittings, and many of them, were required to make any impression whatsoever; in the clinic, in charity practice, it was out of the question; it was only they who could afford to pay well to whom this luxury, such as it was, was accessible. I have never forgotten the remark of Dr. Goodell, in one of his clinical lectures, in which he tells his students of the advantage of electricity in a certain case, and that he would then use it for purposes of demonstration, but that, as a rule, however effective, this remedy was a luxury, out of the question for the poor; and

so it was by the old method, by reason of the length of time required for each sitting, and the number of sittings necessary.

As to the time occupied, I shall again refer to Dr. Mundé as the best and most recent American exponent of gynecological electro-therapeutics; he advocates sittings of fifteen to thirty minutes, and in pelvic inflammation, from thirty minutes to one hour (in the latter case I would allow from three to five minutes). He says, further, "In order to obtain a result, an appreciable benefit, from galvanism, it must be used often, steadily for a long time, every other day better than less frequently, and a course of treatment should last from three to six months."

Dr. F. H. Martin, of Chicago, who reports some cases of uterine fibroid (*Journal of the American Medical Association*, July 17 and 24, 1886), achieved his success in one case in forty-five treatments; in another, in fifty-two treatments of fifteen to twenty minutes each.

The idea has been a weak current as long as possible, and as often as possible, forgetful of the fact that these locally ineffective currents, by reason of their diffusion, affect other parts, and by long-continued use may do injury in distant organs. At all events, this element of time has deterred many from testing the merits of the current, and I trust, when it will be shown that results, positive and unquestioned, can be achieved in a few sittings of from three to five or eight minutes, this objection will fall, and a new era will, indeed, have been inaugurated, as an unusual amount of perseverance and spare time is no longer essential to success.

9. Lack of proper electrodes, as well as of instruments of precision.

As another cause of failure hitherto, I must mention the want of proper electrodes, which is true in this country at least, and the universal adhesion to the forms adopted by neurologists, above all, the everlasting, small, round, sponge electrode; it will appear more clearly in the discussion of

the apparatus necessary for gynecological treatment how much depends upon shape and material of the electrode used, and how completely a clumsy or unfitted electrode will destroy or alter the effect of the current.

The total absence of galvanometer (graduated in milliamperes), and of rheostat (graduated in ohms), prevents all possibility of record or uniformity.

In brief, no results have been obtained, no progress has been made, as the electric current was used without a knowledge of its greatly varying qualities, regardless of the effect of its poles; without any knowledge of dose, even in intensities far too weak to accomplish definite results; thus demanding endless time, long sittings for many months, and, in addition, the possibility of affording relief was diminished by ill-suited instruments for its application.

OUTLINES OF THE METHOD PROPOSED.

I have endeavored to demonstrate that reasons sufficient exist to account for the failure of electricity as a satisfactory therapeutic agent in gynecological practice, and I, at least, am fully convinced that it is not the fault of the remedy, but that ignorance of its nature, of its varying qualities, and of the method of utilizing these for this particular purpose are accountable for the want of success.

This mysterious fluid, which has power sufficient to shatter the firmest structures of God or man by an instantaneous flash, and which has proved, under the guidance of science, a force sufficient to move a train, or to carry human thoughts or words thousands of miles, can hardly prove ineffective as a therapeutic agent, and certainly possesses power sufficient to accomplish all that may be asked of it. That it is most supple, and adaptable to a great variety of purposes, is demonstrated to us daily: we see it carrying our messages, moving our engines, illuminating our cities; may we not justly expect it to serve a variety of purposes in medical science? Is it not reasonable to suppose that the qualities of this agent already utilized by us in our work should be capable of still greater modifi-

cation and development? To gynecological therapeutics it seems especially well adapted, on account of its peculiar influence on the nervous system, with which the sexual organs of woman are so intimately connected. Should we not succeed in molding and in guiding this agent, which upon other fields has proved so pliable and so yielding to man's ingenuity, responding to a whispered word or the touch of a finger?

The science of gynecological electro-therapeutics has entered upon a new era, and the first progressive step was taken when Apostoli, of Paris, in 1883, presented his memoir on the treatment of uterine fibroids to the French Academy, in which he published his results, based *first*, upon the use of electric currents of an intensity hitherto unknown in medical practice; and, *second*, upon the limitation of effect to one active pole, which must be placed within the cavity of the uterus, or in the tissue of the organ itself.

Although this had reference to the treatment of uterine fibroids, I have based upon these laws the teachings here enunciated, and I look upon this innovation as one of the most important features of the method I have framed for guidance in gynecological electro-therapeutics, the salient points of which, characterized by their deviation from previous practice, I shall now present.

1. The formation of strict indications. 2. Differentiation between the varying forms and modifications of galvanic and faradic currents. 3. Differentiation between the active and indifferent pole, and observance of the polar method in galvanism. 4. Localization and concentration of the current. 5. Precision in dose and measure. 6. Use of strong and effective currents. 7. Short sittings. 8. Use of appropriate apparatus.

1. *The Formation of Strict Indications.*

Strict indications should be formulated for the use of the galvanic and faradic currents, as much so as for the giving of belladonna or chinin; scientific experiments, and accurate record of results empirically obtained, as well as the condi-

tions under which this was done, are necessary, and from the accumulated evidence, indications for the use of the agent must be developed. That this may be done, we must thoroughly understand the varying qualities of galvanic and faradic current, and use these, under proper conditions, as we use certain medicines. Electricity must no longer be considered as a unit, as a remedy serviceable in a certain case; it is a name applied to a form of treatment which varies as much as surgical treatment does. We resort to electricity as we do to surgery, and frame our indications, not for surgery, but for the kind of surgery—how the knife is to be used—not for medicine, but for the kind of medicine.

2. *Differentiation between the Varying Forms and Modifications of Galvanic and Faradic Currents.*

The choice of current and pole, the nature and form of the electrode, and, in faradic electricity, the nature of the coil and frequency of interruption as well, determine varying therapeutic results; we must endeavor to establish the properties of each, and differentiate in their application, so as to utilize each of these varying qualities for its proper end.

I will enumerate the factors upon which the modification of the current depend as far as I have myself observed; the causes for such variation, or their therapeutic effect, I can not as yet fully detail.

GALVANIC ELECTRICITY

FARADIC ELECTRICITY

Characterized by

Continuous action with greater quantity, less tension (while static electricity possesses great tension but no quantity), producing in the main a chemical effect.

Variable, interrupted action, moderate and variable tension and quantity, producing in the main mechanical effects.

The effect varies

With the *intensity* of the current and its deflections.

With the quantity determined by the distance between primary and secondary coil.

With its *constancy*, whether continuous, increasing, decreasing or broken.

With *time of use* the most important variation is the difference between *the effect of the two poles*.

Form, moisture, and material of the electrode also serve to produce very distinct results.

With the *number of interruptions* with time of use.

No appreciable difference in the therapeutic effect of the poles. The positive, the less painful, is of more general service.

The most important variation is determined by the changing *tension*, dependent upon the length and thickness of the wire composing the secondary coil.

Nature and form of electrode also produce very different results. *Penetration* of current varies with moisture and material of electrode.

Striking as is the difference between the effect of the positive and negative poles of the constant current, diametrically opposed in their chemical action, I have discovered no difference between the poles of the (faradic) interrupted current, when used as such, and it is natural that it should be so, as with each interruption the current springs from pole to pole—to and fro. The negative pole is, however, the more intense and painful, and for this reason I prefer the negative for revulsion and the positive pole for the majority of applications, believing that the effect is the same, while the pain inflicted is less.

An accessory apparatus may be attached to the faradic battery, by which the direction of the current becomes stable. With this a certain chemical action is attributable to the poles, and then differentiation is in order.

The idea of the variable effect of the ascending and descending current may, I am convinced, be cast aside, even in the treatment of nervous affections, since then, also, the polar

effect is of greater importance than the direction of the current.

3. *Differentiation between the Active and Indifferent Pole, and Observance of the Polar Method in Galvanism.*

In gynecological electro-therapeutics, it is not the current from pole to pole, but that from a certain pole, and at that pole the effect of which is mostly desired. The interpolar effect of the current proper must not be overlooked, and should be utilized; in certain cases it is the only possible means of treatment, but I look upon it as secondary to the effect of the pole itself, and since the qualities of the two poles differ so greatly, we can utilize only one in a given case. We have seen how diametrically opposed the most important, the chemical, action of the two poles is, the negative attracting alkalis, the positive the acids; hence, to achieve a certain object we must use a certain pole, which may be termed the *active pole*, upon which all forces must be concentrated. The pole must be of such shape and material as best to accomplish the desired object; the smaller the surface; the greater the concentration of the electric force, the more intense the effect. The effect of the other pole must be eradicated as much as possible; this I call the *indifferent pole*, as it is an unavoidable element, unimportant in itself, yet a necessary part, as the handle is to the knife. That it may be painless and ineffective, we seek to disperse the current at this point, hence a broad, flat electrode is usually employed, which I call the dispersing electrode.

For the relief of a stricture of the internal os, in which case, if the stenosis be caused by induration or hyperplasia of the uterine walls, the electrolytic effect of the negative pole is desired, a uterine sound or a metal dilator, insulated up to within an inch or an inch and a half of the end, is attached to the negative pole of the battery, and its exposed part inserted into the canal at the point of stricture; this is the active pole, while a large, flat, well-moistened electrode, six by nine inches large, is placed over the fundus uteri;

this is the dispersing electrode, by means of which the effect of the positive pole, which is not wanted, is reduced to a minimum, and this then becomes the indifferent pole; none of its peculiar features are noticeable; though a powerful and characteristic effect be produced by the active negative pole. The density of the current is lessened as the surface over which it is spread increases; the greater the surface the less each unit of surface receives; if the electrode be very large, this is a minimum, and the pole is rendered almost entirely inactive. This method is well characterized by the term *polar*, on account of, first, the distinct differentiation between the effects of positive and negative pole, and, second, the limitation of active force to one active pole.

4. *Localization and Concentration of the Current.*

In gynecological practice it is, as a rule, desirable to reach certain circumscribed parts. That this may be accomplished to the best advantage, that the current may be utilized to its fullest extent, it is concentrated upon the part in question, and withheld as much as possible from other parts; in other words, it is localized.

The active pole should be placed directly in contact with, if not within, the tissue to be affected, and the indifferent pole as near to this as is possible to admit of the current's penetrating the entire part to be reached; that is, the part which is to be subjected to the action of the electric current should lie directly between the two poles. Thus, the electric force is utilized to its fullest extent, with the least possible radiation into healthy tissues, which is of extreme importance in the use of currents of great intensity.

To stimulate contraction of the uterine muscle, one pole should be in the cavity near the fundus, and the other below the internal os, thus confining the current to the part to be acted upon—the uterine muscles. If this second pole be placed upon the small of the back, upon the iliac region, or even over the fundus, the intensity of action is diminished, or a stronger current is necessary to accomplish the same effect, and the superabundance of electric fluid causes a ra-

diation throughout the surrounding tissues, often extending along the course of distant nerves. If we seek to contract muscles by acting upon the motor nerves, we place one pole in the cavity upon the terminal fibers, and the other upon one of the main trunks, where it is nearest the surface. We must concentrate the current as much as possible upon the one part, so as to obtain the greatest effect with the least possible radiation into healthy parts; it should be dispersed directly beyond its center of action, by the large surface of the dispersing electrode, at the indifferent or neutral pole.

The old and generally accepted teaching, still upheld by Tripier, I must point out as erroneous and injurious; it is, "to place the indifferent pole as far as possible away from the place to be affected, so that the current may be dispersed and its effects as feeble as possible upon the various paths it takes through parts of the body not to be reached." This diffusion should be altogether avoided, as it may become dangerous with the use of strong currents; yet this has been the favorite and universal method, placing the indifferent pole in the hand, on the back of the neck, or in a foot-bath, but it must now yield to localization.

An excessive and unnecessary resistance is inserted by this dispersing of the current, and powerful currents, such as I use, would require an enormous battery-force, and would prove dangerous if applied in this diffuse way. This is strikingly exemplified by facts: In one instance, in which I passed a current of one hundred and eighty milliampères through a uterine fibroid, extending from the floor of the pelvis almost to the navel, the resistance represented by electrode, cutis, and that portion of the tumor between the cutis and negative pole, a stylet inserted to three fourths of the depth of the tumor, was equal to but two hundred and fifty ohms. Had the positive pole, which was represented by a plate covering the entire abdomen, been placed in the hand, this resistance would have amounted to thousands, and the attempt would have proved simply impossible.

5. *Precision in Dose and Measure.*

The intensity of the current used must be a definite and known quantity; precision in measure and dose is a *sine qua non* to successful electro-therapeutics. This can hardly be disputed; precision of dose in the administration of so powerful a remedy is as important as it is in the giving of morphia or chinin; the ampère, which has but recently been determined upon by the international congress of electricians as the unit of measure for the intensity of the galvanic current, has inaugurated a new era, and has opened the way to positive results and progressive scientific work. The ampère meter is to the electro-therapist what the scales are to the apothecary, the steam-gauge to the engineer, or the compass to the mariner; and though it is apparently appreciated as such, so lauded by a few of our latest writers, not even they have as yet made use of it, but still tell us of the number of cells used, after having taken care to explain the intense vagueness of the expression.

For purposes of comparison, and that we may attain approximately accurate results, we should note the intensity of the current in milliampères; the size and character of the electrodes used; the external resistance which is measured in ohms by the rheostat; and the quantity of electricity employed during the entire sitting, as measured by the coulombmeter in coulombs. The now generally accepted units of measure, and those most important, are—

The *ohm*, which is the resistance offered to an electric current by a column of mercury 1.⁰⁶ metres long, and 1 millimeter square.

The *volt*, which expresses the electro-motor force, and is about equal to that of one Daniel element.

The *ampère*, which expresses intensity, represents the intensity of a current of one volt passing through one ohm.

The *coulomb*, the measure of quantity, represents an amount of electricity equal in effect to that of one ampère

passing in one second of time, or the quantity that passes in one second of time against one ohm of resistance under an electro-motor force of one volt.

The intensity of the current which passes through the body is the element of importance to the practitioner, and, as measured by the milliampère metre, the galvanometer, represents the dose actually taken, while, if desired, the entire intensity of current used can readily be found after we have determined the resistance of tissues and electrodes by the rheostat.

A measure of quantity is not necessary in electro-therapeutics, though it is desirable for purposes of scientific investigation. Quantity represents the stock on hand, from which the dose is given, all that is on hand at the time, what is used, and what is wasted, and in practical therapeutics we know and care nothing about this. For the exact use of the galvano-cautery, however, we must have a knowledge of quantity, since this determines the properties of the cautery, the quantity representing the force utilized in heating the wire, and being all so expended. The degree of heat attained is in exact proportion to the quantity of electricity used, which varies with size rather than number of cells. Intensity is here of no import; great quantity, derived from large elements, is demanded for the proper heating of the cautery; in the therapeutic use of galvanism, small quantity is preferable, and the effect depends upon the intensity, the number of elements. This intensity is measured by the galvanometer, but it must be distinctly understood that it is not the absolute intensity of current which is so shown, but so much of it, such intensity as actually passes through the organ treated; the entire intensity less the resistance of electrodes and tissues.

In medical electricity the thousandth part of the ampère or the milliampère is the practical unit.

The instrument which is used for this determination of intensity of current is the ampère metre, or galvanometer, and is still, a very unfortunate circumstance for the progress

of electro-therapeutics, a rare and a very expensive instrument, the cheapest being those of Barret, of New York, at \$25, while those of other makers range from \$50 to \$150. The instrument usually sold as such is a galvanoscope, which is a mere indicator of activity and direction of current.

I have endeavored to render my observations as accurate as possible, and can hence vouch for their precision and correctness, and will here explain my method as far as it is necessary to answer such objections as may be made, and have in fact been made.

A prominent electro-therapist has affected to ignore the galvanometer, on the ground of inaccuracy, claiming that we were as yet without instruments of sufficient precision, and that they were moreover so seriously affected by magnetic conditions and accidental surroundings as to render them practically valueless.

This is decidedly erroneous; we have accurate instruments, and can overcome or account for the accidental deviations, precisely as the mariner does in his compass.

My galvanometers, like the rheostat, and, in fact, all my apparatus, are scientifically accurate instruments, made by Gaiffe, in Paris, and tested by him and by myself. I have four galvanometers, one graduated up to two hundred and fifty, another to one hundred and fifty milliampères, and two graduated to one hundred milliampères; these correspond exactly, and correspond as precisely with three galvanometers in possession of my colleague, Dr. Herman, Professor of Nervous Diseases and Electro-Therapeutics at the St. Louis Post-Graduate School of Medicine, one a Gaiffe, a horizontal, tangent galvanometer, and the other two perpendicular instruments from Störner, in Dresden; hence I am positive as to the accuracy of the instruments, and to avoid and correct accidental errors, due to permanent or variable surrounding conditions, I have placed one in the course of each current, and repeatedly exchanged them and varied their positions. The grossest error I have discovered has been a deviation of

five milliampères, due to the proximity of the heavy helix of a faradic apparatus.

The amount of iron in our houses, furnaces, stoves, steam-coils, and gas-pipes, certainly influences the galvanometer, but it may be placed so as to avoid this to a great extent, and if a fixed place be assigned it, it is a simple matter to determine this deviation once and forever, as we do for a compass, by the use of the rheostat, and an element of known electro-motor force. This in explanation and in answer to objections which I should be sorry to see on account of their possible effect upon the professional mind.

The graduated wire rheostat is desirable if not as necessary as the galvanometer, while the water rheostat serves rather for the purpose of inserting a resistance, though it may be used as a crude measure when graduated by comparison with a wire rheostat. The wire rheostat, or any scientifically exact instrument, serves to measure the resistance offered by the tissues, and is valuable in controlling the accuracy of the work. A voltameter, or coulombmeter, I propose to use for the purpose of determining the total amount of electricity used during the sitting, but as the two coulombmeters I had ordered arrived in an irreparably damaged state, I have been obliged to conduct my work during the past winter without their assistance, a defect which has now been remedied.

6. *Use of Strong and Effective Currents.*

It seems but natural that a current should be used of sufficient intensity to accomplish the desired result in the shortest possible time, without injury to the patient.

Hitherto currents altogether too weak to be effective have been used, and to this we must, among other reasons, ascribe the incompleteness of results; it is evident that when a feeble remedy is indiscriminately used, and widely disposed at that, but little can be expected. Tripier, it may be recalled, speaks of a current of from 8 to 15 milliampères as one of average strength, and calls all over 20 excessive, and Ranney says that "no patients will endure a current of over

20 milliampères through a high resistance, and that very few will bear over 12 milliampères." What he calls a high resistance he does not state, and vague assertions such as this merely aggravate the existing confusion.

How weak the currents used, even by scientific operators, are, is evident from the fact that many galvanometers are not made to register over 20 milliampères, few as high as 40 milliampères, and the highest, those of Gaiffe, register not over 50 milliampères.

From this the strength of the currents generally used may be readily gathered since, like the thermometer, the instrument is made to indicate somewhat above the range of possibilities.

To Apostoli is due the credit of boldly passing boundaries which seemed already fixed by practice; in his work hitherto recorded he has used as high as 100 milliampères, and last fall, during my attendance upon his clinic, he had begun to overstep this then most extreme limit, using up to 120 milliampères, and had ordered an instrument which should indicate 150 milliampères. I did the same, but, during my winter's work, I found that even this intensity, hitherto unknown in medical electro-therapeutics, seemed insufficient, and that I could accomplish results more readily and more effectively by currents even stronger. As far as I could judge by the limited range of my galvanometer, and by the aid of the rheostat, I had used up to 200 milliampères! I have since obtained an instrument indicating 250 milliampères, and a recent letter from Apostoli informs me that his experience has been precisely similar, which confirms my belief that a wide range of possibilities is open to electro-therapeutics.

Such intensities are possible and called for in gynecological electro-therapeutics, where we are generally dealing with circumscribed parts, provided the localized polar method be adopted, by which we obtain low resistance and limitation of the current. I must again emphasize that in all that I have said I have had reference to electricity in *gynecological* prac-

tice, and only to galvanic and faradic electricity, not to static electricity or to large quantity galvanism as used for the cautery.

I do not claim that such high intensity of current is always judicious or necessary. I sometimes use only 1 or 2 milliampères, often from 20 to 40, more generally 40 to 80, and merely wish to establish the fact that if desirable, if necessary to accomplish the effect intended, currents of greater strength can be used without injury to the patient, without causing undue pain, and without the use of anæsthetics. To relieve the painful symptoms caused by a spasmodic contraction of the vesical sphincter, a vesico-abdominal current of 2 milliampères may suffice; to destroy a urethral caruncle, 20 or 40 milliampères may be needed. To promote absorption and contraction in subinvolution of the uterus, a negative electro-cauterization with from 40 to 60 milliampères will be useful; for effective electrolytic action, from 100 to 200 milliampères is called for.

Having once determined the intensity necessary to accomplish a certain object we must apply this, remembering that we need no longer be hampered by that old cast-iron obstacle to progress, the universal rule at once to reduce or to stop the current when it begins to give pain—a true but misapplied maxim. The electric current should indeed not cause undue pain, and still we should use, regardless of this, such currents as will best accomplish the end in view! A mild galvanic current stimulates functional activity, promotes absorption; a stronger current contracts and exsanguinates. A non-metallic positive pole with a mild current relieves pain, reduces congestion; with a stronger current it causes greater pain than the negative pole, and, if a metallic electrode be used, it cauterizes.

The active pole, *in utero*, or in the tissues, must not even cause discomfort, a certain amount of pain, when upon the site of the indifferent, external pole is harmless, but need never be excessive, as this may be relieved or modified by greater dispersion of the current. Thus, in treating a uterine

hyperplasia, when it is desirable to utilize a current of 60 or 100 milliampères, the negative pole, attached to a platinum needle, is inserted into the uterine tissue, and the positive pole, as an earth- or punk and chamois-covered metal plate directly over the fundus uteri, may cause intense burning pain, but if no discomfort is experienced internally, we need not at once stop treatment or reduce the strength of the current; by merely replacing the abdominal electrode, which may have been a plate three by four inches, by one considerably larger, we afford the desired relief; the larger plate, say six by nine, will disperse the current, at this indifferent pole, more satisfactorily, and the pain will cease, or, at least, it will be reduced.

Possibly the utility of these high intensities will be denied, and it will be claimed that weaker currents will accomplish the same end if the sittings are but prolonged. I will say that, regardless of the importance of this element of time, a weak current, used for a greater length of time, is to a strong one applied in short sittings as one twenty-fourth of a grain of morphia given every four hours is to one fourth of a grain given at bed-time—i. e., once in twenty-four hours. The action is often a very different one, as is that of the small but repeated doses of rhubarb or chinin, which we well know has a decided effect, the one as a gastric stimulant and an appetizer, and the other as a general tonic, while in large doses the one is a purgative and the other a febrifuge. The effects may even be antagonistic, as is that of varying quantities of calomel, which we give with success in small and repeated doses in the diarrhea of infants and which in large doses is a most potent purgative.

For certain purposes weak currents are called for, but, however prolonged their use, they can never replace the higher intensities. The strength of the current to be used depends upon the effect to be obtained, and is somewhat modified by the susceptibility of the part and of the individual.

7. *Short Sittings.*

The result should be accomplished in the briefest time feasible, and the sittings should occupy as little time as is compatible with the attainment of the object in view.

Not only is the necessity for long sittings no more present, but they are even forbidden by the use of strong currents, hence a saving of time which at once renders the agent available, no longer making it impossible for the active specialist to apply it, and withdrawing all obstacle to its use in pauper clinics.

While we read, even in the most recent literature, of treatments of twenty to thirty minutes, every other day, extending through months, as in the case mentioned of the reduction of a fibroid taking up fifty-two sittings of twenty minutes each, I have checked hemorrhage, relieved pain, and destroyed small growths in from two to three sittings of five minutes each. Results are now within reach!

Short sittings are a necessity, but the time depends upon the object to be accomplished, as much as it does on the strength of the current, and must become a definite quantity as much so as the strength of the current itself. As a medicated bath is inefficient when used too short a time, and injurious when overdone, so it is with the use of the electric current, and even a weak current may do injury by being continued too long, as the prolongation of the harmless sea-bath may do mischief, or the continued use of small quantities of calomel, which is more likely to salivate than the giving of a single larger dose.

8. *That proper instruments for observation and treatment are necessary need hardly be insisted upon, yet I am obliged to call attention to this fact, as they have been heretofore wanting.*

APPARATUS NECESSARY IN GYNECOLOGICAL ELECTRO-THERAPEUTICS.

Galvanic Battery and Accessory Apparatus.—As to the selection of a *battery* I have nothing to say, believing that all the batteries now made for medical purposes are service-

able, whether stationary or portable, and the various kinds of each are so much alike that the choice must be left to the individual. I would merely urge that the battery contain a sufficient number of cells, according to their character, from twenty to forty—thirty upon an average. I would incidentally mention that I look upon those cells which have proved most efficient in steady use for telephone purposes, the Diamond and the Gonda-Leclanché, both modified Leclanché elements, as the best and by far the cleanest for a stationary battery. Portable batteries are now all very much upon the same plan; the large elements, which were formerly used when a powerful battery was desired, are no longer seen; all important for cautery purposes, when quantity is desired, they have completely yielded to elements with smaller surface for therapeutic purposes.

A current *selector* is necessary that one element may be added after another without producing a shock; the current *changer* or *commutator* which accompanies almost every battery, I have never used in gynecological practice, and I do not consider it necessary or even desirable.

A *galvanometer* to measure the intensity of the current is an absolute necessity. I regret to say that I have no experience in American instruments; as yet, no instrument indicating above 50 milliampères, is in the market. I have used the absolutely reliable instruments of Gaiffe and Störér—the former horizontal the latter perpendicular—but even these are to be had as yet only upon special application for intensities above 50 milliampères. Ere long, if scientific electro-therapeutics be taken up by the profession, the necessary apparatus will become more accessible. The wire *rheostat* and *coulombmeter* are desirable for purposes of investigation, but not necessary in practice. It is the *electrodes* of which I would more especially speak, as these are by far more important than is generally supposed, the nature of the electric current being frequently changed by the character of the electrode with which it is applied—in faradism the penetration of the current depends upon them, and in galvanism

the electro-chemical action is intensified or almost annulled according to the material of the electrode—which we have been in the habit of looking upon as without import, a mere conductor like the rheophores, one being about as good as another.

That the active electrode determines the character of the current, has always been appreciated to a certain extent, and instruments have been fashioned for the various organs to be treated.

As equally important, however, I look upon the use of proper dispersing electrodes, which have been absolutely neglected, and then I would beg that the old standard sponge electrode, that filthy current-absorbing instrument, be done away with; it is fit for nothing but for the application of deep localized faradic currents, and even for this purpose the more cleanly absorbent cotton serves equally well, if not as a better conductor. Of these dispersing electrodes we should have standard sizes, and I believe that none more serviceable can be found than those I have been using; the smallest, $3\frac{1}{2}$ " by $4\frac{1}{2}$ ", the second, which is of the greatest general adaptability in gynecological practice, $4\frac{1}{2}$ " by $6\frac{1}{2}$ ", and the largest, $6\frac{1}{4}$ " by $9\frac{1}{4}$ ", and by 10". In case records the size and material of this instrument should be given, but that comparisons may be more readily made, uniformity of dimensions is desirable.

The following general truths will perhaps simplify the idea I wish to convey:

For the covering of small electrodes a more cleanly and cheap, moisture absorbing material should be used in place of the sponge, which is filthy by reason of constant use, and even when well soaked with warm salt water offers too much resistance by reason of the greater mass necessary. If we take absorbent cotton or flannel, this can be renewed at each application, and we are free to use the same electrode, covered or uncovered, as the case may demand.

Varying sizes of large, flat electrodes for the dispersion of the current at the indifferent or neutral pole should be on

hand. These must be from a small plate three by four inches up to a size large enough to cover the abdomen, say eight by ten.

They should consist of a thin, pliable metal plate of lead or tin alloy, perforated by small holes to allow the attachment of the covering and the better diffusion of fluid. They may be covered, either as mine are, by a layer of punk held in place by a thin sheet of chamois or gauze, or like those of Apostoli, with sculptor's clay, held in place by gauze. Though the clay hardly holds the moisture better than the punk, it has the advantage of adapting itself more snugly than any other material to the skin, following every irregularity and even entering the depression of the pores, and this is of great importance in the use of strong currents, yet a decided advantage I have not found which should cause me to give up the punk and chamois cover for the clay. A thin layer of absorbent cotton, quilted underneath the chamois-skin covering, answers all practical purposes, serving as a moisture retainer.

In addition to the electrode to be used in connection with the indifferent pole, a variety of forms are needed for the effective use of the active pole; these are for the treatment of uterus, vagina and rectum, urethra and bladder, some so fashioned as to confine the current to these canals, both poles being attached to the same instrument.

I will demonstrate my own armamentarium to exemplify the necessary types. I do not intend by any means to say that these are the instruments necessary in gynecological electro-therapeutics, yet to two of these I wish to call attention. One is my own uterine applicator, by which the current may be confined to any part of the organ, and either of the two parts of which it is composed may be used separately—the one as an intra-uterine, the other as a cervical or vaginal electrode.

The second instrument is the platinum sound, a slight modification, somewhat more delicate than that of Apostoli, which he first used for the galvano-cauterization of the uter-

ine canal and the puncture of uterine fibroids, for which purpose it is movable in the handle, the straight end having a trocar point. Though the non-corrodible metals, platinum and gold, are always preferable, they are too expensive to be used unless absolutely necessary, and this is only the case when in connection with the positive pole, so that it is galvano-cauterization alone, as in the treatment of hemorrhagic fibroids, in which the positive pole is used, for which a platinum sound is necessary.

Faradic Battery and Accessory Apparatus.—Of the innumerable instruments of the kind which are made in this country I know of none that possess the qualities desirable in such an instrument, and as they vary in the character of their make up, they also vary in much less evident, but far more important, features, the character of the current developed, which depends in the main on the length and thickness of the wire in the coil of the secondary helix; the best are those with a secondary coil of medium wire and a variable interrupter.

My own apparatus possesses three sets of secondary helices, the coils of which are of wire varying greatly in length and thickness: Wire of coil 1, $D = 1.4$ mm., 66 m. in length; wire of coil 2, $D = 0.7$ mm., 200 m. in length; wire of coil 3, $D = 0.225$ mm., 600 m. in length. A graduated scale upon which the helix slides, and an interrupter so arranged that its beats vary from fifty to three thousand per minute, and the duration of each beat may again be varied within certain limits as to its duration. By this instrument, the most perfect of its kind made, we obtain a great variety of effects, and develop a valuable agent from this usually almost invariable form of electricity.

The electrodes are those above described, most of which I use alike with both galvanic and faradic apparatus; the bare metal plate, the brush, and the conical electrode are perhaps more intimately connected with faradism.

I myself use a water rheostat in connection with the apparatus, not that it is necessary with an instrument so deli-

Dr. J. S. Billing
Washington

St. Louis, May 14th, 1887.

Dear Sir:—

In the interest of progressive Electro-therapie, I beg to call your attention to the system of Electric Measure and Dosage which I have developed and adopted in this paper, and now respectfully submit for your consideration

I have given —

- The milli-ampère intensity of the current;*
- Size of electrodes for calculation of density;*
- Time of application, for calculation of quantity;*
- Resistance of the tissues in ohms when such resistance was unusual, or when an explanation of the intensity of the current seemed called for.—*
- Rarely noted in this paper.*

Believing not only that a better understanding will be furthered by uniformity of measure and record, but that the success, and the more general adoption, of electricity as a therapeutic agent depends on such precision and uniformity, I should be gratified if you would give this method your consideration, and if it meets with your approval, your sanction and support.

Very respectfully yours,

GEO. J. ENGELMANN.

3003 LOCUST STREET.

St. Louis, May 14th, 1887

The interest of progressive Electricians
I beg to call your attention to the
of Electric Motors and Generators
has developed and adapted in this
which you respectfully submit for your
attention

with simple intensity of the current;
of methods for calculation of capacity;
of application for calculation of quantity;
of the time in which such work
is now assumed, or when an explanation of
intensity of the current would be called for—
very truly in this paper.

being not only that a better under-
standing will be furthered by uniformity of
and record, but that the success,
more general adoption of electricity
specific agent depends on such pro-
and uniformity. I should be gratified
could give this method your consid-
and if it meets with your approval,
action and support.

Very respectfully yours,

GEO. J. ENGELMANN

101st Street.

cately regulated, but as it has served me for experiment. In connection with many of the more ordinary instruments made, it is, however, a necessity, as they are by no means always sufficiently delicate for all the purposes for which they may be called upon in gynecological practice; often, with intensity more than enough, the rheostat serves to modify the current.

THE VARYING QUALITIES OF THE GALVANIC AND FARADIC CURRENT.

Physiologists have for the last two decades known the varying qualities of the electric current as applied to healthy animal tissue, and it is in the main to Robert Remak and to Du Bois Reymond that we owe our exact knowledge of its physiological effects upon nerve and muscle, which vary greatly, according to the character of the current employed; a knowledge which has been practically utilized for diagnostic purposes, and has proved most valuable in the determination of, and differentiation between, central and peripheral nervous disturbances and the various forms of paralysis. I refer to this, not that we can benefit much thereby, since very different results are desirable in gynecological practice, but merely to show that the qualities of the electric current vary greatly according to its method of use, and also that it possesses positive, permanent, yet very variable qualities, readily utilized and recorded when once known.

Unfortunately, the physiological properties which have been mainly studied, and which have proved so valuable to the neurologist, are, in the main, unavailable in gynecological practice; in fact, the very quality most important in the electro-diagnosis of paralytic conditions, the varying effect of the shock produced by the opening and closing of anode and cathode, positive and negative pole, characteristic and marked on nerve and muscle, is unimportant and even to be avoided in gynecological treatment.

I must again repeat that I shall refer only to those variations of the electric current which are of use in this special

department, and to methods of treatment therein applicable, and that I present only the results of my own observations.

THE VARIOUS MODIFICATIONS OF GALVANIC AND FARADIC
ELECTRICITY AND THEIR THERAPEUTIC EFFECTS.

The galvanic current, which is characterized by its steady, constant action and greater quantity, possesses deep penetrating power and a very decided chemical action; hence it is valuable above all for the purpose of destroying morbid tissue and causing powerful contraction—the action of strong currents; and of changing their chemical and vital stability, promoting absorption of morbid structures, and stimulating healthy nutrition—the action of weaker currents. Odd as it may seem, the nutritive and denutritive effects are the result of the same force; the absorbent action, denutritive action on pathological structure, is not determined by any destructive tendency, but by heightened functional activity and osmosis, increased nutrition, and stimulation of healthy action, thus promoting the ends of nature, the absorption of diseased tissue. Permanent vascular contraction by strong currents may also result in the same retrogression.

In the therapeutic use of the galvanic current we rely

The faradic current, on the contrary, is marked by its interrupted action, possessing less penetrating power, and its most prominent therapeutic effect is mechanical, upon muscular tissue; it is used mainly to accomplish muscular contraction, stimulation, and for bringing about superficial irritative revulsion.

The effect being produced by the opening and closing of the current, the more frequent its interruption the more effective the current; hence, the very rapid action, two to three thousand interruptions a minute being the number generally used; the current from the secondary coil is mainly employed because this possesses greater penetrating power.

entirely upon its stability, and in gynecological electro-therapeutics, the continuous action alone is developed.

For the contraction of gross muscles only is the opening and closing shock admissible.

The effect of

The galvanic current, above all other forms of electricity, is characterized by its quantity and intensity; in gynecological electro-therapeutics the most decided results from this agent are achieved by the use of the greatest possible intensity. The effect of the current varies greatly with this; high intensities serve for chemical cauterization and destruction of tissue, while lower intensities act as alteratives and sedatives.

The most variable and yet important qualities are those determined by the positive and negative pole.

The *negative pole* (—) is called the cathode; upon this the bases are deposited, the molecules of tissue being called cathions; this is the pole chemically most active, it causes greater pain than the positive pole, it is the irritating pole; as Apostoli, who calls it the *pole fluidifiant* claims, it produces a soft, non-retractile

The faradic current being due to the opening and closing of the current, as a rule a current with very frequent interruptions is used, two thousand per minute, thirty per second, this being the number producing tetanus of striated muscle; hence, having the most general effect on this tissue. The effect of the current varies with the number of interruptions, with the nature of the helix in quality, with the kind and moisture of electrode, and with its strength, which is varied by the distance between primary and secondary coil. The soothing effect of the faradic current is best attained by the utmost frequency of interruption, while muscular fiber is most intensely irritated to contraction by very slow interruption.

A difference between the therapeutic effects of the two poles I have not discovered, although we must differentiate in their use so far as to avoid

cicatrix, it possesses the highest potency of the destructive and denutritive action of the galvanic current; it is antiphlogistic and tends to further or produce hemorrhage. This pole is the effective factor in electrolysis, and by reason of its intense chemical action and separating and absorbing power, the active pole in galvanopuncture in the treatment of fibroids and peri-metric exudations.

The catelectrotonic action is characterized as modifying, irritating, stimulating, strengthening, or refreshing, as it is used.

The *positive pole* (+) is the anode; about this the acids accumulate; when used with metal electrodes these are corroded and firmly imbedded in the tissues, hard to withdraw, hence a gold or platinum electrode only should be used with the positive pole with currents of any strength; the molecules are called cations; it is the less painful pole, sedative with mild currents; the cicatrix it causes, though harder, is retractile; this is the coagulating pole, in part by reason of the accumulation of acids, in part by reason of the contractile action of strong currents, it is decidedly hemostatic,

placing the negative pole upon the most sensitive place, since this is the more painful. If revulsion is desired the negative pole must be used; for most purposes the positive is preferable. I shall, however, continue my observations, as I am by no means fully satisfied as to their identity.

The *tension* of the current is a quality possessed by faradism in a higher degree than by any other form of electricity; it determines to a great extent the peculiar effects of the current, which may be greatly varied by changes of this property.

It is a grievous fault of the faradic batteries made for medical purposes that they can not be sufficiently regulated; the strength of the current only can be changed, but the most important feature, the tension of the current, is fixed; it is as grave an error as if all spectacles were made for hypermetropia, varied only in number, in the strength of the glass; such spectacles would be precisely as useful to ophthalmological patients as the faradic battery of the market is for therapeutic purposes—very good for some, but harmful to others.

The tension varies with

whether for this reason or its effect on the vaso-motor nerves, I can not say ; it seems also to have a sedative influence.

Upon the anelectrotonus we mainly rely to relieve profuse discharges, to check hemorrhage, and relieve congestion and irritability of nerve or muscle, to quiet the sensory, motor, and vasomotor tracts, to overcome neuralgias, spasms, and hyperesthesia.

We rarely use the caustic properties of the positive pole, as it destroys without promoting absorption in the surrounding tissues, it acts like a powerful acid, cauterizes deeper, destroys more tissue than the negative pole, but without corresponding electrolytic action of the interpolar current. Yet it is far preferable in certain cases, as in the destruction of *nævi* and hemorrhoids, where circumscribed action is called for and the coagulating hemostatic effect of the acid is desired.

length and thickness of the wire forming the secondary coil, and each battery, if not for a definite purpose, should have a number of these coils ; their effect varies so much that, other conditions remaining equal—strength of current, number of interruption, shape, material, and moisture of electrode—I have found a curative and decidedly soothing effect from a coil of high tension, while one of less tension gave such pain as to be unbearable. A current of feeble tension and greater quality, as developed by a short coil of thick wire, has the best contractile effect on the muscle, giving least pain. The current from a long coil of fine wire, a current of high tension and less quality, affects the muscle much less, but the nerve more ; the muscular effect of the short, thick coil is heightened by the moist electrode, which produces a penetrating current.

Penetration of the faradic, and of the galvanic current somewhat, depends upon the *moisture* of the electrode.

A chamois, cotton, or clay covered electrode, moistened with warm salt water, gives the greatest penetration to the faradic current, and must be used for the treatment of deep-seated tissues.

The dry metal or carbon electrode produces a decidedly

superficial current, which is most effective as an irritant, to produce revulsion.

The faradic current varies in its therapeutic effect, according to its tension, penetration, intensity, or frequency, and is used to produce muscular contraction, allay inflammation, soothe pain, allay nerve-pain, stimulate tissue, and produce revulsion.

Let it be distinctly understood that a judicious use of all the variable elements which combine to determine the effect of the electric current, galvanic and faradic, is necessary to develop the qualities above mentioned, and unless this be done, contrary results even, may astonish the careless operator.

The physical and therapeutic qualities I have attributed to the various factors named pertain to them under certain conditions only, and they are mentioned as those qualities which we desire to obtain, and which are most fully developed by these factors, or as the objects most perfectly accomplished by them when properly aided.

The intensity of the current, the shape, material, and moisture of the electrode, and the time of sitting, all serve to determine the effect; thus the positive pole has been called a sedative, an antispasmodic, and so acts more effectively than the negative, if this can at all produce an approximate effect; but it acts thus only when used with a moist cotton electrode and a mild, slowly developed current; if applied otherwise, it would increase pain, cauterize, or produce spasm. While the faradic current produces sharp revulsion when properly applied, a strong current of high tension with a dry metal electrode or a metal brush used for a short time, it will soothe irritation if a mild current is used with a soft, moist electrode for a longer time; to the negative pole has been ascribed the highest chemical action; true, when used with a strong galvanic current and applied with a pointed metal electrode, if this electrode be covered with cotton or chamois, this action is annulled or reduced to a minimum, according to the strength of the current; muscles may

be contracted or relaxed, tissues may be destroyed or invigorated, according to the manner in which various agents are utilized.

This best shows the attention to detail and the scientific accuracy which is necessary for a successful use of electricity, how carefully we must dose the remedy, and with what judgment it must be given if it is to relieve.

The physician will now appreciate why he has failed to find the information sought for in his text-books, and why no appreciable results have been vouchsafed his most persistent efforts, and why effects often the very opposite of those promised have astonished him, when he supposed himself following the prescription laid down. These prescriptions have been as vague as if they had told him to administer a bitter remedy in case of malaria, without defining the kind, the dose, the time, or method of administration.

One of the most variable factors, which has been little appreciated, is the kind of electrode used, by which the qualities and the effects of both galvanic and faradic currents are greatly varied.

I have stated that a moist, non-metallic electrode develops the penetration of the faradic current, the dry metallic electrode its superficial effect; with the metallic electrode alone is the chemical effect of the negative pole of the galvanic current most fully attainable, and as the density of the current, the intensity of effect, is proportionate to the size of the electrode in inverse ratio, its shape is as important as the material of which it is constructed; while the indifferent pole should always be large, so as to disperse the current and render it ineffective, the active pole must be of a form and material commensurate with the object to be accomplished.

THERAPEUTIC EFFECTS OF THE ELECTRIC CURRENT AS USED IN GYNECOLOGICAL PRACTICE.

The galvanic current, in the main possessing deeper penetration and higher chemical effects, is used for its effect on the nerve-center and upon the tissues direct, to destroy and

absorb, for the relief of chronic inflammatory conditions; while faradism, by reason of its contractile effect on the muscle, is applicable to all conditions in which this may be of advantage, whether for the stimulation of muscular fiber, or the contraction of the vascular coats in inflammatory conditions; while the faradic current may check inflammation by limitation of the blood supply, and relieve chronic conditions, in contractile tissue, by massage as it were, the galvanic current relieves by reason of increased nutrition, vascular relaxation or contraction, according to the intensity of the current, and by increased functional activity in the tissues, the establishing of an active molecular interpolar current resulting mainly in a concentration toward the negative pole; a congestion is then produced, the capillary vessels are dilated, and carry off more rapidly the increased refuse which gathers.

A molecular separation is caused, called fluidification by Apostoli, which we see well represented by the action of the pole on water; precisely the same division takes place in the moist tissues, and the result depends upon character and intensity of the current, as well as the condition of the tissue; in healthy tissues a moderate current will merely hasten the healthy, natural changes, while a stronger current will destroy, as the disintegration produced is beyond the scope of physiological repair. The catelectrotonic action of low intensities, non-metallic electrode, is to stimulate: capillary blood-vessels and lymphatics are dilated, muscular activity increased, osmotic changes hastened; this is used to produce healthy irritation. The anelectrotonus serves to overcome morbid irritation of nerve and muscle.

In morbid structures the process of absorption is inaugurated by disintegration, the gathering of the refuse at one pole, where it enters the dilated capillaries by endosmosis and is carried off; stronger currents contract vessels and produce direct destruction in too great an extent to be carried away by absorption. The agent is one so varying in its effects that it must be used with skill and judgment; inflam-

mation or destruction may easily be produced by the use of stronger currents or metal poles, and, instead of an absorbent, we have a phlogistic or a caustic. Retrograde metamorphosis is promoted by penetrating currents from non-metallic electrodes, while the concentrated current from the metallic electrode develops local chemical action.

Therapeutic results and physiological experiments clearly demonstrate the chemical action of the galvanic current as a disintegrant, a chemical cautery without heat; physiological experiment has shown the attraction of molecular parts to the negative pole; if a current is used of insufficient strength to absolutely disintegrate, yet to separate, the moisture of the tissues admits of a current in the direction of the negative pole, and thus an engorgement is produced, the following congestion is facilitated by the irritation of the pole; by endosmosis the molecules gathering at the negative pole enter the dilated capillary blood-vessels and lymphatics, and are carried off in the efforts of nature to re-establish the equilibrium.

This is a very easily verified experiment, and a physiological observation upon which therapeutic work must be based; what is true of healthy tissue is also true of tissues which have undergone morbid changes, and as Nature is always ready to repair, if repair is possible, we can assist the natural tendency of a healthy organization by inaugurating such artificial accumulation of morbid material, and its carrying off, by developing and stimulating absorption.

No harm is done by the action of the current upon healthy tissues, since this is limited in the polar method, either by diffusion and dispersion of the current, until it is inoffensive, or by concentration upon diseased parts and morbid tissues, avoiding healthy structure altogether. The electric current merely hastens and intensifies the changes constantly taking place; if in healthy tissues, the tendency is to increased activity and repair; if in tissues morbidly changed, it is to approximate the normal by removal of the morbid particles; hence the effect upon healthy parts of even the high intensities, as

now proposed for therapeutic use, is not to be dreaded. It is evident how much the effect of the current must vary according to its intensity and method of application, since we see that the negative metallic pole with great intensity is a destroyer, a caustic, and a moderately diffuse non-metallic negative pole, an absorbent, an antiphlogistic; but, unless care be taken, the temporary congestion produced, which favors restoration and healthy action, may become intensified, and we find the same pole acting as a congester and inflamer.

The electric current, polar and interpolar, serves to accomplish a variety of apparently antagonistic effects; it acts as a nerve sedative and stimulant, muscular contractor and antispasmodic, antiphlogistic, counter-irritant and vesicant, tonic and promoter of development, absorbent, chemical caustery and escharotic, destroyer of tissue, electrolytic, hemostatic and decongestor, promoter of hemorrhage and congestion.

THERAPEUTIC USES OF ELECTRICITY.

IN GYNECOLOGICAL PRACTICE.—The electric current is most useful in chronic conditions, but is also applicable in sub-acute stages; less so in acute inflammations, in which the greatest judgment and delicacy of manipulation is necessary. It is an error, however, to suppose that acute conditions counter-indicate the use of electricity; nothing so readily relieves the intense suffering caused by rheumatic inflammation as the electric current, which I have known to succeed when all other means—even opiates—have failed. The sedative influence of faradic currents of high tension quiets the irritability of nerves and vessels, and Remak already has taught the quieting action of a mild anelectrotonus on nerve and muscle, as well as on the vasomotor tracts, and has so treated contusions and inflammatory swelling. To gynecologists the field is new, and I am confident that excellent results will reward the investigator; the application is comparatively unknown, on account of the scarcity of material, since the battery is not carried in a pocket-case by the practitioner, and

acute diseases do not present themselves in the office—where the battery is stationed; they are at home, in bed; moreover, all teachers have concurred in the unfounded statement that the use of electricity must be confined to chronic conditions.

Both galvanic and faradic currents are effective when used, either alone or in connection with other remedies, in the treatment of many of the most troublesome of the tedious disorders of the female pelvic viscera. I have obtained excellent results from electricity in the following conditions:

1. Neoplasms of various kinds: fibroids, polypi, and cystic growths, urethral caruncles, and hemorrhoidal tumors.
2. Chronic pelvic inflammation with induration and extravasations, parametritis and perimetritis.
3. Uterine hyperplasia.
4. Chronic ovarian inflammation.
5. Occlusion of the os and stenosis of the uterine canal; atresia.
6. The relief of engorgement and the accompanying pain.
7. Subinvolution.
8. Prolapsus uteri when due to the relaxation of tissue.
9. It is a valuable aid in the correction of various forms of displacement.
10. Metrorrhagia, whether due to neoplasms or relaxation of tissue.
11. Certain forms of amenorrhea.
12. The relief of many of the annoying reflex symptoms; the hystero-neurosis.
13. Chorea and other nervous disturbances accompanying puberty and the menopause.
14. Constipation due to inactivity of the muscular walls and dilatation of the rectum.
15. Painful or difficult micturition, when due to spasmodic contraction or relaxation.

IN OBSTETRICS.—It has proved a valuable therapeutic agent for the relief of the following conditions: 1. Uterine inertia, during and after labor. 2. Weakness and irregularity

of labor pains. 3. Post-partum hemorrhage. 4. Imperfect involution. 5. Paralysis of urethra and bladder after labor. 6. Extra-uterine pregnancy.

For the induction of premature labor, for which this agent has been of late greatly advocated, I have never used it, for the reason that we have better means, equally effective and physiologically more correct, to accomplish the same object, and I would not recommend it, though I am sure that it would prove serviceable.

I deem it wrong to inaugurate premature labor by uterine contractions; we should follow the course of nature, in which I take the muscular contractions to be but secondary. The result of overdistention, and the separation of tissue by reason of degeneration, thus making the ovum a foreign body and an irritant, which then arouses the contractile fiber to activity. Hence I believe that the warm douche for the softening of the tissues, and the introduction of the soft catheter between chorion and decidua, if the former fails, are the correct means, and simulate the natural process most closely.

For all the above conditions I do not advocate electricity as the only remedy, but as equally worthy of trial with other remedies; it is valuable and effective in some cases only in connection with other means; but in others it is the main or only therapeutic agent.

In cases of hemorrhagic and unoperable fibroids, in certain forms of chronic perimetritis, in amenorrhea and subinvolution, in hyperplasia and stenosis, I consider the electric current as the most valuable and effective method of treatment. In others it is merely an aid to treatment, as in prolapsus uteri, by contracting and strengthening the weakened tissues; while in still another class of cases, however effective, it is but one of more means toward accomplishing the same end, and unless a battery be on hand, or certain peculiar reasons for its use exist, the practitioner will adopt means with which he is more familiar, as in post-partum hemorrhage, while a faradaic current of low tension, or the positive

pole of the galvanic battery with occasional interruptions, will overcome this dangerous condition as certainly as the intra-uterine injection of hot water or the perchloride-of-iron swab, there is then no particular reason for using this cumbersome apparatus.

CONTRA-INDICATIONS TO THE USE OF THE ELECTRIC CURRENT.

Idiosyncrasies alone contra-indicate the use of the electric current.

Idiosyncrasies will be found more particularly in subjects which come under the treatment of the gynecologist, since these are in the main sensitive nervous organizations, which are peculiarly liable to unexpected effects from nervines and sedatives, and react to the electric current precisely as they do to other remedies of that class; to limit and prevent this general or constitutional effect of the electric current as much as possible, radiation and distribution must be avoided by close localization.

However carefully this may be done, constitutional effects can not be entirely prevented, and are often sufficient to forbid this method of treatment in these peculiar organizations.

In these patients the general effect of the current as a nervine or a tonic is of course out of the question, since the effect is injurious; but even the polar treatment of local parts is rendered impossible, however successful it may be, by reason of the unhappy constitutional results from the small interpolar and the radiating extrapolar portions.

Some are affected by galvanism only, some by faradism, others by both. I have been obliged to cease treatment in a case in which a displacement was being remarkably improved, by the use of faradaic electricity, on account of the dizziness caused and the intense headache which followed; and, in a case of chronic cellulitis, the treatment, which was developing most excellent results, was discontinued on account of the nausea produced. In another, the consequent muscular twitching and nervous excitement forced me to desist.

In some cases the secondary or accidental constitutional effect is most pleasing, decidedly invigorating, causing a healthy glow and a feeling of vigor and freshness, as in a case in which I used powerful galvanic currents for the destruction of a neoplasm. A healthy color overspread the face, and the patient expressed her delight after each sitting at the pleasant glow which followed at once, and at the refreshing effect of the treatment during the following day.

Pain in the site of the indifferent or dispersing electrode, it must be remembered, signifies nothing, as this can be overcome.

Active inflammation is claimed to counter-indicate the use of electricity, a view which is the result of our insufficient knowledge, and I am hardly willing to make a more definite statement than this—that little or no benefit has been derived in severe acute inflammations, as far as our present knowledge of electro-therapeutics extends, and that the current must be used with great care when attempted in such cases. Efforts must be made to develop the application of the agent in this direction.

In all subacute inflammations electricity must be used with care, and in certain cases moderate currents only are applicable. Apostoli says that, in cases of acute metritis, endocervicitis, endometritis glaireuse, and subacute perimetritis, galvanism must be used with care, and mild currents only applied, not exceeding from forty to fifty milliampères, since nervous spasms and hysterical attacks are likely to follow if this is done.

I am hardly willing to make so definite a statement, since I have found that the condition of the case and the individuality of the patient are factors of such importance, and I am not prepared to say more than that high intensities are not borne by these patients, and that we must proceed with extreme caution; but I cite the warning of Apostoli, since I lay great stress on the dictum of this enthusiastic and progressive observer.

To recapitulate, I believe that the only positive contra-

indication to the use of the electric current as a therapeutic agent, is to be found in the idiosyncrasy of the patient, and this we must discover by slow and careful progress during the application; when existing, this is as insurmountable as the peculiar susceptibility to certain internal remedies. As morphia, in place of quieting excites some, so does the electric current develop such strange, unlooked-for effects, and it may well be compared to this narcotic, since in some peculiarly organized systems it produces a dizziness, a congestion, or nausea very much like that drug.

As in some sensitive organizations a single grain of chinin produces a sufficient febrifuge effect, and more would not be borne, so we will meet with some who bear but weak currents, yet these suffice to accomplish the desired result; all such cases, however, are exceptional, and the average effective dose of electricity is as uniform and as generally borne as that of any other remedy.

POSSIBLE ILL RESULTS AND DANGERS ACCOMPANYING THIS TREATMENT.

The judicious use of the electric current in gynecological practice is accompanied by so little risk that I have come to look upon *the rapid and perfect relief from pain as the most dangerous accident which can occur*. Hemorrhage may be caused by careless puncture, or by injudicious use of the negative pole; inflammation may follow the use of strong currents injudiciously applied in sensitive parts, or, in more active conditions, pain may be aggravated by careless applications, but these are results which should not occur and will not happen to an observant operator.

Minor accidents due to neglect of mechanical details or slight imperfection in the apparatus are more liable to occur, and may prove quite serious with the use of high intensities. The most frequent of these is shock caused by the sudden making or breaking of the current, or by unexpected contact, and cauterization of tissues by imperfect insulation of electrodes. This may happen in a variety of ways, and is not

an infrequent occurrence until the operator learns to attend thoroughly to the numerous details which assume importance only with the increase of intensity, and which have never been considered, as they were harmless while weak currents were used. Shock by sudden making of a current of high intensity may be caused by imperfect contact; the circuit is opened, the patient does not feel the current, and the operator adds element after element, still no sensation; he deems his battery weakened, and adds more; traction on a rheophore, pressure on an electrode, or circumstances unknown suddenly establish the metallic connection, and a current of high intensity flashes through the unsuspecting patient; or the operator may assume that all connections are made, and adds element after element, when he observes that a main contact is wanting, a switch wrong, or, if a dip battery, his elements not immersed, and, without returning his key to the O point, he at once corrects the error, to the detriment of his patient; the current is suddenly established in full strength, and produces the dreaded shock. Had the operator observed his galvanometer, and carefully tested all connections before closing the circuit, this could not have happened. During treatment, shock may be caused by the sudden breaking of the current by the detachment of an imperfectly fastened rheophore, dropping out or yielding to accidental traction. A careless motion of the patient's hand, a deep inspiration, will cause a making and breaking of contact which is felt as shock. The uterine sound, when used as an intra-uterine pole, may slip, and thus break the connection; or, if imperfectly insulated, it will touch the speculum, causing intense intrapelvic burning, or it will come in contact with the vaginal tissues, and in a few moments a charred streak marks its course; the edge of the abdominal plate may press against the flexed thigh, or a jarring of the battery may cause undulations of the current. These are annoyances, injuries result only from the making and breaking of currents of high intensities.

As absolutely harmful, above all to the ignorant, I con-

sider the sudden relief from pain which may follow a first application of the electric current; the relief afforded is like that from a powerful anodyne, without any of the unpleasant symptoms which accompany the latter. Pain and suffering which has continued for years may be relieved or dispelled by a single application, and the patient feels well; unmindful of the fact that it is the symptom of pain alone that is overcome, and that the disease itself is precisely as it was before the application, all precautions are cast aside, and acute exacerbation of the trouble is soon brought about. This is a result I have repeatedly witnessed, and I am sorry to say that I look upon the wonderful sedative influence of electricity as its greatest danger; from the use of no other remedy do we so frequently achieve such perfect immunity from pain. Even among my clinical patients I not infrequently hear such expressions as "I have not felt such comfort since I was a girl," or "This is the first time in five years that I have been free from that terrible suffering at the time of my period." The statement of another was that she could "hardly realize that she was the same person," and this after a single application, without noticeable improvement in the disease proper. No longer guided and guarded by this warning symptom, precautions cease, a carelessness which the thoughtless patient pays dearly for, especially so as it is in cases of cellulitis that this is very likely to happen.

Dangers from the judicious use of electricity there are none; more or less annoying accidents are liable to occur through inattention to mechanical details during the treatment, and the most serious results are those from carelessness which follows the perfect well-being established by the use of the current.

METHOD OF APPLICATION.

The *diagnosis* having been determined, and the *indications* for the use of the current established, the *activity of the battery* must be ascertained; this is readily indicated by the

galvanoscope, in case of the galvanic battery, and by the application of the wire ends of the rheophores to tongue or finger in the faradic, after a mild current has been established; if the wires pass near the galvanometer, a deflection of the needle will be caused which serves an excellent purpose to demonstrate the presence of the faradic current.

CONSENT OF PATIENT.—This must always be gained before entering upon treatment, since a feeling of holy dread of this mysterious agent still pervades the public mind, and, moreover, almost every one has at some time or other, often in school days, experienced a shock from an electric battery, perhaps a very painful one, as this toying with electric apparatus in absolute ignorance of its terrible power is altogether too common.¹ The patient's idea of electricity is pain and shock; this must be dispelled, and she must be assured that she will experience no shock and no pain, that she will feel a slight, not disagreeable burning or prickling, which will not be unpleasant, and may even give immediate relief.

The method of application may be briefly described, so that she is prepared for whatever may come, and not be rendered nervous by the dread of a possible explosion. She should know what is coming, and be promised immunity against shock and severe pain.

CHOICE OF CURRENT AND ELECTRODES.—In determining the method of treatment, we must bear in mind, precisely as we do with other remedial agents, the various physiological qualities and therapeutic effects of the current and pole to be used, as well as the secondary features of the case; we must,

¹ I shall never forget the unfortunate girl who came under my treatment while in charge of the practice of Professor Politzer in Vienna, who had been rendered deaf—completely deaf—by a shock from a faradic battery, playfully administered by her sister; the apparatus had been recently received for the use of their paralyzed father, and the girl had been taught its use, when, thinking to frighten her sister, she clapped the electrodes firmly upon both her ears, and in an instant the damage was done. I saw the patient ten days after the accident, and no improvement was noticeable during the week she remained under treatment; still, I was in hopes that her hearing would slowly return.

above all, defer to the hemostatic qualities of the positive pole and hemorrhagic tendencies of the negative. For example, in the treatment of a uterine fibroid, the electrolytic action of the small metallic negative pole would naturally be resorted to, but we must inquire into the conditions of the case: if the patient suffers from hemorrhage or profuse menstruation, this would be aggravated by the negative pole, and we must content ourselves with the less effective action of the metallic positive for the sake of overcoming the hemorrhage until we can with safety use the agent mainly indicated.

Various objects are accomplished by the different poles, and by different methods of using the galvanic or faradic current. We must decide upon the method of treatment in accordance with the importance of these objects. Thus, in the treatment of para- and peri-uterine inflammations, we utilize in diffuse chronic forms the absorbent and stimulating action of the current with non-metallic negative as the active pole; if pain is a prominent feature, the sedative action of the positive; if an effusion exists, the electrolytic effect of the negative metallic pole; the method of application or the kind of current and pole used must depend upon the effect which at the time is of paramount importance. If excessive suffering accompanies the application, we seek the sedative action of the non-metallic positive pole of a mild galvanic current, or the quieting effect of a faradic current of high tension from the secondary coil of fine wire; after the suffering is allayed, we resort to the absorbent or electrolytic action of a stronger negative galvanic current, or the contractile and stimulating effect of a faradic current of quality and low tension, as the case may be.

In defining the therapeutic effect of the various factors, I have only given, as I have been careful to say, the effect most characteristic of a certain pole and current, regardless of surrounding conditions, and we can readily decide which to use. But where the conditions are so that such pole or current produces an injurious effect, we must either first

overcome these conditions, or use other factors which may tend toward the same end, though less effective.

The difficulty lies in the choice of the electrodes to be used in connection with the active pole, since this determines the result; the neutral or indifferent electrode is selected in accordance with the intensity of current to be applied; the small plate will suffice for intensities up to 20 and even 40 milliampères; the medium electrode must be used if the intensity is increased to 60 or 80 milliampères, and the large abdominal plate for all over this. Should the burning caused upon the side of the indifferent pole be excessive, a second dispersing plate is employed, and may be placed upon the thigh, in connection with the same rheophore.

The electrode in connection with the active pole must first of all be adapted in shape to part to be acted upon.

For purposes of irritation or revulsion, and for cauterization and electrolysis, a metallic electrode must be used.

For penetration, and for a sedative effect, we resort to the moist non-metallic electrode, so, also, when the object in view is the increase of functional activity and the furthering of absorption.

Penetrating currents from moist non-metallic electrodes are necessary to reach the nerve-trunks and centers.

The indications for kind and intensity of current have been given; bearing in mind these various factors, the form of application determined upon.

THE ELECTRODES MUST BE CAREFULLY PREPARED.—The non-metallic, penetrating electrode must be rendered aseptic, and the dispersing, indifferent electrode must be moistened—until the covering material is well soaked—in warm salt water, and its superabundance expressed so that it does not drip; yet it must be sufficiently saturated to hold its moisture throughout the sitting without being evaporated by the heat of the body, and even to thoroughly moisten the skin and soak the epidermis. Warm water is used, as cold would be uncomfortable, produce shock, and even do injury in sub-acute inflammatory conditions, many of which come under

treatment, and in which the abdomen is kept carefully warm, and rendered sensitive by hot poultices and douches; moreover, the warm water is a better conductor, and for the same purpose salt is added, which aids immensely in reducing the resistance. For electrodes used in cavities, or on mucous surfaces, it is well to renew the covering for each sitting, and absorbent cotton should be used; upon rectal or vaginal electrodes this is an absolute necessity. Metallic electrodes which are used in cavities, or within the tissues, must, like other surgical instruments, be rendered thoroughly aseptic; they should be steeped in strong solutions of corrosive sublimate or carbolic acid, or burned out as Apostoli does his platinum electrodes; the insulating cover must be treated in the same way; hence, this should be of glass whenever possible, and independent of the electrode itself.

PREPARATION.—For ordinary treatment no particular preparations are necessary, as I slip the thin, flat, rounded electrodes I use in place, under the clothing, without disturbing this.

My electrodes are so arranged that this is easily done; only when I use high intensities of current, and when I am obliged to place large dispersing electrodes upon the abdomen, do I have the corset removed, that they may be readily placed, and that the patient is assured the utmost comfort and freedom of respiration.

When properly prepared, if necessary, she is placed in position upon the ordinary gynecological chair.

I make these applications, precisely as I do all others, in the dorsal decubitus, with the legs well abducted and flexed, upon my gynecological table.

PLACING OF ELECTRODES.—The electrodes are now placed in position; the moist, broad dispersing electrode is first placed, and, when snugly fitted upon the part it is to cover, the rheophore is attached and the patient directed to hold it down, care being taken that her hand nowhere comes in contact with a metal portion of the electrode, and for this reason I generally place it over sheet and clothing, directly above

the site of the instrument (if on the abdomen), and caution the patient to keep up a gentle, perfectly steady pressure. This is necessary to insure a continuous, steady current, as its intensity depends somewhat upon this pressure, and its evenness upon the equality of pressure and the constancy of contact; it is preferable that the basis of the electrode be a pliable metal plate, so that it is well adaptable to the undulations of the body; punk, sculptors' clay are good coverings, as they enter every pore and wrinkle, thus insuring complete adaptation; any variations of pressure or contact produce undulations of the current, and shock, if anywhere broken, as it may be by a sudden motion, or a respiration which is not carefully followed by the hand of the patient holding the electrode. These extreme precautions are, of course, necessary only when high intensities are used, as in the treatment of fibroids or cellulitis, for then the shock of the opening and closing of the current is intense and very injurious.

The indifferent electrode is first placed so that it may adapt itself snugly to the part, and, if externally, on the skin, that it may thoroughly moisten and soak the epidermis, the dry coat which this forms offering a great resistance to the passage of the current, thus weakening its effect and increasing the pain by the friction caused in its efforts to penetrate; if very strong currents are to be used, the dispersing electrode at the indifferent pole should be put in position a few minutes earlier, so that the best possible preparation may be made, the epidermis thoroughly soaked, and the pain reduced to a minimum.

An example from my case-record will serve to illustrate this fact, and will at the same time convey an idea of the extent of the variation produced by the time of contact; in a case of electrolysis, with the negative pole as a platinum stylet in the mass of the tumor, and the positive electrode, a lead plate six by nine inches upon the abdominal surface, the tissues presenting a resistance of 260 ohms, the circuit was closed, as usual, a few moments after the placing of the

electrodes, when the discomfort caused thereby had subsided ; in one minute, by gradual increase, an intensity of 85 milliampères was obtained, twelve elements of a fairly active dip-battery being used ; within a few minutes, as the epidermis became thoroughly moistened, and the resistance had been overcome as much as possible, an intensity of 89 milliam-pères was developed, no additional element being added and everything remaining *in statu quo*, while the degree of pain was decidedly lessened. After four minutes the current was slowly decreased, and in one half minute reduced to its minimum, when the circuit was opened and the current broken ; during this process, four cells showed an intensity of 24 milliampères, while in the beginning of the treatment, as the current was being increased, they accomplished an intensity of only 10 milliampères ; two cells showed a strength of 11 milliampères, to 4 milliampères on the increase five minutes earlier ; no sensation whatsoever was experienced, while considerable burning was caused by the same number of cells at the earlier stage. A comparison of the intensities, as produced by the same number of cells with an interval of five minutes, during which time the epidermis had been soaked, and the path of the current established, clearly demonstrates the variation thereby caused. In a negative vagino-abdominal galvanization, an intensity of 50 milliampères had been attained with nine cells, and in the course of one and one half minute. As the epidermis became saturated, the intensity increased to 100 milliampères, without augmentation of the burning from the dispersing electrode. This excessive increase was due to the fact that the dispersing electrode had not been applied but a moment before closing the circuit, and time sufficient had not elapsed to admit of saturation of the tissues.

Intensity during the increase of the current in the first minute of application.	Number of cells.	Intensity during the decrease of the current in the sixth minute of application.
	1	5
4	2	11
7	3	18
10	4	24
15	5	31
18	6	39
27	7	45
36	8	54
46	9	62
58	10	70
70	11	80
85	12	90

It is by the size of this electrode, the dispersing electrode

at the indifferent or neutral pole, that the current is made bearable; though its intensity is equal at both poles, it is dispersed over a large surface, here where no particular effect is desired, and where we wish to reduce the sensation to a minimum; the stronger the current, the larger should be the dispersing electrode; and if one, however large, does not suffice, two may be used, both upon the abdomen, or one upon the abdomen and one on the thigh, the rheophore being divided if this is done. Care must be taken, however, that the length and conductivity of both parts be equal, lest the current follow but one, the easier path.

In case that the indifferent pole be not within convenient reach of the patient's hands, care must be taken to hold it firmly in place by some other means.

The active electrode must be carefully chosen with a view to the object to be accomplished and the part to be reached, and must be placed as near as possible to the tissues to be acted upon, if not within them, while the indifferent pole is in as close proximity as will admit of the electric current passing through the tissue to be affected, and no more, the resistance being thus diminished and the work facilitated, the current concentrated, admitting of the greatest possible therapeutic effective, with the least possible radiation throughout the body, to reduce the secondary or accidental effect to a minimum.

The active pole is the instrument proper, and must be placed with precision, care being taken that, if of metal, every particle not in action is thoroughly insulated and nowhere in contact with the tissues, or the metal of the speculum, if it be used through this. If contact is anywhere established, the efficiency of the current is impaired, and extremely disagreeable accidents may happen; if a strong faradic current be employed, the system will be violently jarred; and if it be a galvanic current, used for electrolytic purposes, a fearful shock will be experienced if the pole comes in contact with the speculum, and if it touch the tissues it will burn its way into them in a moment. The insulation

must be complete, and sufficiently dense; in using a bit of old rubber catheter to insulate the inactive or extra-uterine portion of the stylet, which was nowhere broken, but not of pure rubber, and moistened by the secretions, patients have complained of intense pain at the vulva, a very sensitive mucous surface, which was evidently affected by the slight amount of current escaping through what I had supposed an impervious covering. If these portions are shel-lacked, as is often the case, they must be carefully examined before using, as it is easily rubbed through, or in some way broken.

Whether stylet, needle, uterine sound, or vaginal applicator, this active electrode must be placed with precision and held in position by the operator, that it may be immovable while in action, or changed as may be indicated, and the effect constantly observed.

CLOSING OF THE CIRCUIT.—When these arrangements have been made, the rheophore is attached, and the preparations are now complete for the closing of the circuit; but this must be delayed until all pain or discomfort caused by the placing of the electrode has ceased, that the operator may know precisely the sensations to attribute to the current itself; when the intra-uterine electrode is used, the stylet in neoplasms, or an instrument in the bladder, this precaution is extremely important; moreover, it permits the patient to calm down and familiarize herself with the situation, and affords time for the excitement caused by the first attack to subside. All connections are once more inspected, screws tried, tightened, the operator reassures himself as to the fixation of the rheophores, the perfect insulation of the electrodes, and the cessation of pain, and he is ready for work. The circuit is closed, and the current established. The patient should be warned of what she is to expect, the pricking or jarring of the faradic current, the burning of the galvanic, and should again be assured against excessive pain; this can be truthfully done, since the current may be dispersed to any extent at the indifferent pole; if it gives

pain, the electrode need only be replaced by a larger one to relieve this. To the ignorance of this fact the limitation of electro-therapeutics to absurdly feeble currents heretofore is due, as well as the mischief occasioned by those who have attempted the use of stronger currents, which have either caused excessive agony, or have been administered under chloroform, necessitating anæsthesia for every sitting, and always producing an escharotic effect, burning the skin, which is entirely uncalled for. The active pole, when within the pelvic organs or their tissues, need not and should not cause any discomfort, certainly not pain.

The operator, firmly holding the thoroughly insulated active pole, and closely observing his galvanometer, to retain control of the current, but at the same time keeping an eye on his patient, to detect any expression of pain or any accidental movement that may disturb the electrode, then slowly increases the strength of the current, until the desired intensity is reached.

In the use of the *faradic* current the maximum intensity is generally attained by slow increase, but for some purposes a sudden inaugural intensity is desirable. In gynecological practice, the stable effect of a current of a certain strength, galvanic or faradic, which has been slowly developed, is generally employed, and this is in the same way slowly decreased, sometimes only suddenly cut off. The effect varies with the manner in which the maximum is reached, as it does with the time of its continuance.

The therapeutic effect of the *galvanic* current sought in gynecology is derived altogether from its constant quality. This continuity and constancy is developed to the highest degree in this form of electricity, and this we utilize to the exclusion of other properties. The galvanic current possesses three periods, each with different qualities, the variable periods of the opening and closing of the circuit, and the permanent one of the passing of the current; the former are extremely valuable in electro-diagnosis, but injurious, and to be avoided in gynecological electro-therapeutics. The

permanent period, electrotonus, should be so long that the temporary, though more violent, effect of the variable periods, the shock at the making and breaking, may be overlooked, and as it is injurious, it should be reduced to a minimum, which is done by opening and closing the galvanic current at its very weakest, thus rendering the opening and closing shock imperceptible. In the course of from one half to one minute the maximum intensity is attained, retained during the *séance*, and then diminished in the same way, before again opening the circuit and breaking the current.

In first applications the effective intensity is, of course, more slowly attained, sometimes allowing the current to continue with less force, so as to enable the patient to accustom herself to the effect, and the operator to observe the result. When the susceptibility of the patient and her endurance of the current is once fully understood, and she herself has become habituated to the treatment, the desired strength may be more rapidly reached.

THE STABILITY OF THE CURRENT determines in part its effect, and in gynecological practice the utmost constancy is required, absolute in galvanism; hence we have no need of interrupter or current changer, the effect of the opening and closing shock must be obviated, and the most perfect repose of all potential factors is required. This is so important, when high intensities are used, that the utmost equality of pressure upon the electrode is necessitated, as well as perfect repose of the patient, and evenness of respiration; a cough, the motion of a muscle within disturbing distance of the electrode, and, if a portable battery be used, a heavy footstep on the floor, will suffice to produce a series of most disagreeable and injurious shocks, which are at once demonstrated to the operator by vibrations of the galvanometer needle.

To produce powerful muscular contraction alone is an unstable, a labile or interrupted, current admissible; thus in post-partum hemorrhage, when we utilize the opening and closing shock by frequent making and breaking of the cur-

rent, as in faradism. For the relief of constipation, the labile application of the abdominal electrode is of service, and for the purpose of stimulating certain nerve-trunks a labile application of the pole over the course of the main trunk is effective; but in gynecological treatment proper stable applications only are admissible.

Stability of current and electrode is likewise required as far as compatible with the nature of that form of electricity in faradism; for purposes of revulsion only or for superficial effects is a moving to and fro of the electrodes, a labile current, or sudden increase and decrease of intensity warranted.

DURATION OF THE SÉANCE.—The time of sitting I would limit to from two to eight minutes, with five minutes as an average; this, at least, has been the usual duration of my treatment, which has proved extremely effective, yet I am not prepared to declare this a standard, as increasing experience may develop new facts. All I claim is that positive results are now within reach, without that waste of time demanded by the prolonged sittings as formerly advocated, and pressure of work need no longer deprive us of that valuable remedy.

The time of sitting depends upon the object to be attained, the susceptibility of the part under treatment, and the individuality of the patient; and not in any way upon the strength of the current, as has often been stated. Tripier, hitherto our authority, says that weak currents may be used for a period of from ten minutes to one hour, while currents of moderate strength are limited to from three to ten minutes, and very strong currents, according to the effect desired, from three to five minutes. His meaning is clear, when we remember that he calls currents over twenty milliampères strong currents, and names forty milliampères as the limit of the possible.

Again, he says that very weak currents may be continued for days; this I doubt; if it were feasible, it might prove injurious, like the undue prolongation of a simple bath.

INTENSITY OF CURRENT.—By the proper application, localization and dispersion of the galvanic current, as it is possible and practicable in the use of the polar method, a wide range of possibilities has been opened to us, and Apostoli, who first ventured upon this absolutely untrodden field, has pointed this out as a safe and possible path to follow.

Since he has demonstrated that an intensity of one hundred milliampères may be used with success and with safety, and that results are facilitated by such currents, I have, emboldened by the results of his progressive work, made use of still stronger currents; judging by my galvanometer, which is graduated only to one hundred and fifty milliampères, and which I have far overstepped, I have made therapeutic use of currents of two hundred milliampères and over. This in case of uterine fibroids, in which I was enabled to reduce the resistance to two hundred and five hundred ohms, by the approximation of the stylet within the neoplasm to the abdominal electrode.

Whether great advantage is gained thereby, I can not as yet say, but I have satisfactorily demonstrated the possibility of the successful use of any intensity that may be necessary to produce a desired effect, and that without causing excessive pain or producing an eschar upon the site of the neutral electrode.

The pain arising from the abdominal or dispersing electrode is experienced as an intense burning at first, but bearable by reason of slow increase. After the maximum has been attained, the current remains stationary for two or three minutes, while the pain usually diminishes, and may even decrease, until it almost ceases, and a mild burning sensation only remains.

The stylet, plunged from two and a half to three inches into the depth of the tumor, causes no pain or discomfort, nor does the dispersing electrode produce any ill effect. At the end of sittings of from six to eight minutes the abdomen appears slightly reddened, but not hot, and revealing no eschar, if the plate is perfectly covered.

I will not undertake to define absolutely the intensity of current which is best for certain purposes. This can only be determined by increased experience and the comparison of accurately recorded results; nor will I here definitely prescribe the dose that may be most effective; but in my case-record the doses I have applied and their effects will be found, which may serve as a guide, and from them a fair estimate may be formed. I can for the present only lay down this general axiom, that the dose, the intensity of the current, and the time of application must be proportionate to the result to be accomplished, and to the urgency of the symptoms, modified by local and constitutional susceptibility.

PAIN EXPERIENCED.—I return again to this feature, because hitherto it has been all-important as the guide to the intensity of the current; in fact, all electro-therapeutic applications were strictly limited by the sensations of the patient; a few only had the hardihood to overstep this limit, so strictly marked by custom, and they quieted the pain by anæsthetics.

Almost all desired intensities can be administered without causing undue pain; and I still uphold the law in a modified form, and assert that it is unnecessary to cause pain. The significance of the symptom depends entirely upon its location.

In *internal organs*, no pain of any severity must be permitted, but for all applications in which an external dispersing pole is possible I would lay down the following law:

Pain caused by the *indifferent* or external dispersing pole is not significant, but uncalled for, and should be obviated by increased dispersing surface—i. e., a larger electrode.

Pain upon the site of the *active* internal pole is inadmissible, and forbids the continuation of any method of application that may cause it.

I heartily indorse the statement of Apostoli, so tersely put: "*il faut que toute operation soit utérinement tolerable.*" No procedure is admissible which causes pain in uterus or pelvic viscera, as I have extended the law; nor is it at all

necessary that any discomfort should be so caused in gynecological electro-therapeutics, if the treatment is carefully and correctly administered ; as a rule, the active intra-pelvic, or intra-uterine pole, even though developing the most intense chemical action, causes no pain, and often, generally, is *not felt*. Let the demands of the case in future determine the intensity of the current, and let us have no more of this antiquated idea of pain as a standard of intensity.

OPENING OF THE CIRCUIT.—The application terminates, as it began, by a gradual diminution of the intensity of the current, and the opening of the circuit when the weakest point is reached, reducing the opening shock to a minimum ; this pertains to faradic as well as galvanic electricity.

The circuit being opened, the rheophores are detached, and the electrodes removed in the opposite order of their application ; the active pole, generally the internal, most annoying, and most difficult to manipulate, is first displaced, and then the external dispersing electrode.

AFTER-TREATMENT.—If the application has been uterine and vaginal, or accompanied by abrasion of tissue, I cleanse the surface and dust with borax or iodoform, applying such tampon as may be indicated. If no special medication is desirable, I place a mere antiseptic supporting tampon. Cleansing of the surface is necessary in case of galvano-puncture where we may have a few drops of blood ; and in case of deep puncture, as in fibroids, I apply a firm astringent tampon, to reduce the danger from the hemorrhage which may follow, sometimes as long as six or eight hours after the treatment, even if the patient be in bed.

If the electrolytic pole has been used, or the chemical cautery, we find a pale, yellowish-white, frothy foam about the negative pole, which must be removed before applying the antiseptic powder and tampon. The same is true of the positive pole, which causes greater destruction of tissue, with less froth, but a detritus somewhat different in appearance, sometimes more white.

If the treatment has been administered in my consulting-

room, and so far it has generally been the case, I advise the patient to rest, as I do after all gynecological treatment, from one half to one hour, though after the simpler electric applications this is not necessary; the rest required varies with the severity of the treatment.

No office treatment should be undertaken in case of large tumors or pelvic exudation and inflammation if it can be avoided. In my clinic this is unfortunately impossible if the patient is to receive treatment at all, and I have treated the most desperate cases, with intensities up to two hundred milliamperes, who had come in the street-car and returned home after resting in an ordinary chair for half an hour, and this without harm, even in acute cases, with the most decided advantage. Subacute, hemorrhagic cellulitis, chronic perimetritis, with exudation and large fibroids, I have so treated, without injury or suffering, attaining unusually rapid and satisfactory results.

In my office I have destroyed small intra-uterine tumors, upon extremely sensitive patients, who returned to their homes after an hour's rest.

For galvano-puncture or galvano-cauterization, with high intensities, I would as yet advise the patient to remain in bed, and apply a cold compress or an ice-bag over the morbid structure treated; although I have not been so fortunate, hitherto, as to operate under such favorable conditions, I have not had a single bad result or a single accident.

CONSTITUTIONAL EFFECTS.—The general effect of the treatment varies greatly with the individual susceptibility of the patient. As has been stated, the effect upon some is such as to forbid the use of the current altogether; excluding these, we still find a great variation; quite frequently, if stronger currents be used, the patient feels a certain weakness, a nerve tire, for the remainder of the day, after the sitting, even if decided relief has been afforded; many continue to feel the pricking of the faradic current, or the burning from the dispersing electrode of the galvanic for hours afterward; some feel exhilarated, the circulation is stimulated; others experi-

ence a dull headache, or gastric disturbance, faintness of the stomach, even nausea. We of course find milder forms of such sensations, which contraindicate the use of electricity when more intense, such as twitching of muscles, shooting pains, or spasmodic contractions. All these more or less disagreeable after-effects, which are not common, are best counteracted by the rest which the patient should take upon her return home after treatment; and the appearance of these symptoms, when discovered, should be counteracted as far as possible by shortening the time of sitting, or reducing the intensity of the current as far as possible.

The most frequent, and fortunately the most harmless, after-effect is a slight tire, which passes away readily with the rest which should always follow the use of stronger currents at least.

FREQUENCY OF TREATMENT.—The number of applications required to relieve or cure varies with the nature and severity of the case, and within limits as broad as other therapeutic remedies; but so much is certain that no extraordinary time is required, nor is it necessary, as even recent authors tell us, that physician and patient must make up their minds to patience and perseverance and at least half a year's treatment to accomplish anything; the electric current is as effective, as decidedly and as rapidly so, as our best therapeutic agents in the same class of chronic affections; in fact, I look upon its action as remarkably speedy and precise.

I have relieved amenorrhea of five months' duration in two sittings of four minutes each (Miss J. L.); neoplasms, from the size of a walnut to that of a hen's egg, I have destroyed in three sittings of five minutes each (Mrs. G., Miss K.). Hemorrhagic discharge accompanying uterine fibroid and cellulitis, which had persisted for months, has been checked by a single application (Clinic); most distressing reflex symptoms accompanying a laceration of the cervix I have relieved after a few treatments (Mrs. H.); large fibroids I have reduced by two or three fingers' breadths in three sittings of five minutes each (Mrs. K.). A lady who has suf-

ferred from insomnia and intense dysmenorrhea, due to a cicatricial stenosis of the uterine canal, has been relieved from suffering, which had continued for over five years, in two sittings of five minutes each. Pain may be at once relieved, and, if the current is used for its anodyne effect, a result should be immediately apparent; some ease should be experienced during the application.

In most instances some effect should be visible after each application, if not already during the sitting; if this be not the case, unless in extremely chronic and persistent conditions, the agent has not been properly applied, if it is at all applicable.

Results are as rapid as could be at all hoped for, from the class of cases to which we apply the remedy; and if we remember that the electric current is resorted to often when other remedies have failed, or relief is impossible by other means, then, indeed, it must be said that the results accomplished are astonishing.

As to the repetition of the dose, the frequency of sittings, that is determined by the nature of the case and the intensity of the current; mild currents may be applied daily, but, as a rule, I believe that equally good results, if not better, are accomplished by treatment every second or third day, as it is customary in other gynecological applications.

Time must, above all, be given the patient to recover fully from any direct effects produced by the procedure; and, secondly, what is less perceptible but equally important, time must be allowed the most complete development of all possible beneficial changes which may result from the application before it is renewed.

In sensitive conditions, or if very strong currents are used, a longer time is necessary for the perfect recovery of the patient and the thorough action of the agent. In electrolysis, and the treatment of fibroids or pelvic extravasations, one, at most two, sittings a week should suffice, and is all that can be well borne; possibly even better results are accomplished if the application is made less frequently, yet this depends, I

believe, on the nature of the case and the susceptibility of the patient.

In ordinary treatment I have repeated the dose every second or third day; in cases of cellulitis and fibroids, as advised by Apostoli, from once to twice a week.

DOSE AND METHOD OF APPLICATION IN SPECIAL INSTANCES,
WITH CASE HISTORIES.

NOMENCLATURE.—To simplify the recording of cases, I have adopted a nomenclature to which I shall adhere in the following case histories, and which I would strongly urge for general adoption, as serviceable and adapted to the wants of the gynecologist, simple and self-explanatory.

The Method of Application is described by the location of the poles, the site of the active pole being named first, that of the indifferent or dispersing pole following. Thus, in speaking of a utero-abdominal faradization, I refer to the application of the faradic current with the active pole, such as the uterine sound in the cavity, and the indifferent pole upon the abdomen; by intra-uterine galvanism, I have indicated the bipolar treatment; that is, both poles in the uterine cavity; if the word negative or positive precedes, this always refers to the active pole, which is the first one named, viz., positive recto-abdominal galvanism tells us that the active positive pole is in the rectum.

Cauterization.—Following the nomenclature of Apostoli, I have termed the application of the bare metal pole to a mucous membrane a cauterization, as it is, in fact, a chemical cautery. Thus, a positive electro-cauterization of the uterine cavity expresses in a concise form the application of a metal electrode, connected with the positive pole, to the uterine cavity, while the current is dispersed by the large plate of the indifferent negative pole upon the nearest cutaneous surface—the abdomen. When the cauterizing metal pole is replaced by a non-metallic pole, such as a cotton-wrapped applicator, in the uterine cavity, the treatment would be termed utero-abdominal galvanism.

Puncture.—The introduction of the needle or stylet into the tissues is called a puncture; thus, in the treatment of a uterine fibroid, where the negative pole, armed with a strong needle, is introduced per vaginam into the tumor, and the current dispersed by the positive pole upon the abdomen, we speak of vaginal electro-puncture of the fibroid; the active pole alone is mentioned as the point of main interest, the site of the neutral pole being always understood to be upon the nearest available surface.

The terms *polar*, *interpolar*, and *extrapolar* will be used to qualify the character of the agent used. In the polar method, which we resort to almost altogether in gynecological electro-therapeutics, the effect sought is generally that of a certain pole upon the tissues in its immediate vicinity—the polar action—and not of the current proper through the tissues from pole to pole—the interpolar action—as in the older methods, especially in the treatment of nervous diseases. We generally seek to gain the desired result by the action of one pole or the other upon tissues immediately surrounding it, that is the polar effect; the interpolar current always exists, and even when secondary we endeavor to utilize it; since the action of the current upon the tissues between the poles is a factor not to be ignored, an effect not to be lost. Where the polar treatment is not possible, we are obliged to rely altogether upon the interpolar current. Thus, in the treatment of chronic peri-uterine inflammation, without effusion—a mere thickening of the tissues—there is no direct point of attack, and we are forced to fall back upon the interpolar current. The active pole, if such we may call it, is a cotton-covered ball electrode in the vagina, while the current is dispersed at the indifferent pole by a plate upon the abdomen.

The *extrapolar* effect is the result of a diffusion of a small proportion of the electric fluid throughout the body, away from the inter-polar region, especially over the nerve-courses. This is usually ignored for purposes of treatment, and reduced in the polar method to a minimum; it is re-

vealed especially by its action on the nerve-centers, on the vascular system, the solar plexus, and the lumbar nerves. It is this extrapolar current, mostly unnoticed in its action, which at times causes those annoying results—headaches, gastric depression, or spasmodic nervous contractions—which contra-indicate the use of the electric current.

I. Neoplasms.

Uterine fibroids, polypi, cystic growths, urethral caruncles, hemorrhoidal tumors.

In the treatment of these affections we use the negative pole of the galvanic current: 1. The polar action of a metallic electrode within the tissues as a chemical cautery or destructive agent; 2. The interpolar current diffused from the non-metallic electrode as an absorbent; and 3. The electrolytic action, which is a resultant developed from the combination of polar and interpolar forces—of the chemical properties of the pole and the current emanating from it.

1. Negative electro-cauterization or electro-puncture; the polar effect. The direct action of the bare metallic pole is that of a powerful chemical cautery, and serves for the destruction of small growths within reach. Thus, small cysts and urethral caruncles, even small intra-uterine polypi and submucous fibroids, are most effectively destroyed by this means.

For small cysts or urethral caruncles a current of from 10 to 20 milliampères suffices for rapid destruction; in intra-uterine polypi I have used from 60 to 80 and even a 100 milliampères, but there is no reason why we should not, if the case demands it, use as high as 200 milliampères, to which we resort in the destruction of larger tumors.

2. The absorbent action of the current. The interpolar effect is the one heretofore commonly used for the reduction of neoplasms; though inferior for this purpose to the direct action of the pole, this force is utilized to promote absorption in diffuse pelvic induration, and in all cases

in which the inflammation has not culminated in a localized deposit accessible to the needle. A smaller non-metallic electrode is placed in as close proximity to the tumor as possible, as the active negative pole, while the current is dispersed on the opposite side in the larger, also non-metallic, positive electrode. This inter-polar application may be resorted to where a more direct attack is impossible.

According to the size of the electrode which we can adapt to the proximal surfaces, a current of from 20 to 100 milliampères is passed.

3. Electrolysis, in which we combine the direct cauterizing effect of the negative pole within the tissues with the absorbent inter-polar action of the current.

This is the most effective method of treatment for larger tumors, the active negative pole, armed with the needle or stylet, being introduced directly into the neoplasm, while the current is dispersed by the large indifferent electrode at the positive pole as near as possible over the mass of the tumor.

According to the size of the tumor, a current of from 50 to 250 milliampères is used.

I.—Negative electro-puncture applied to neoplasms: the destructive and electrolytic action of the negative pole.

The negative pole is generally used in preference to the positive, as it possesses a more decided electrolytic action, promotes absorption more, with less direct destruction or charring of tissue. When destruction direct and hemostasis is desired the positive pole may be used.

CASE I. *Urethral cyst*.—Patient, under treatment for prolapsus due to laceration of the cervix and perineum, was annoyed by a cyst of the size of a cherry-stone at the urethral orifice. This had been punctured once, but refilled. It was then pierced by a small stylet attached to the negative pole, with the small plate as the positive pole above the pubes. A current of 20 milliampères was used for two minutes, which sufficed for the permanent destruction of the annoying little growth.

CASE II. *Myxoma uteri*.—Miss K. (No. 42),¹ uterus enlarged, cavity somewhat distended, completely occluded by myxomatous growths which protruded from the cervix like a cauliflower excrescence the size of a walnut. The patient, a mulatto girl, doing housework, was treated at the clinic, and since the curette was deemed too severe an operation, which would necessitate rest in bed, the galvanic current was used. A large stilet, attached to the negative pole of the battery, was inserted into the mass, after the large plate of the dispersing electrode, at the positive pole, had been placed upon the abdomen; a current of 80 milliampères was used for four minutes. After three sittings, of from 80 to 100 milliampères, for not over five minutes each, upon alternate days, no trace of the growth remained, and the uterine cavity, before completely occluded, presented a clear canal eight centimetres deep and wide enough to admit of the introduction of a lead pencil; no pain was experienced in utero, and the burning from the dispersing electrode upon the abdomen was not excessive. After a rest of half an hour at the clinic, the patient returned to her housework, which was rather severe in midwinter; being obliged to carry an unusual amount of coal, and to walk a long distance, directly after the third application, a cellulitis set in. Had this patient had moderate care, the removal of the growth would have been accomplished without any untoward symptoms, or even any discomfort.

CASE III. *Uterine polypus*.—Mrs. G., a lady who had been afflicted for years with symptoms of heart disease, and had twice, in childbed, suffered from heart clot, came to me in November, 1885, complaining of profuse menstruation, neurosthenia, cardiac neuroses, and other uterine symptoms. I found a fibroid polypus, three quarters of an inch in diameter by two and one half inches in length, with a broad base, attached upon the right side, about and above the internal os. The uterus was enlarged and anteverted, the cervix resting upon the rectum, and the fundus pressing upon the bladder, causing great irritation. The growth could have been removed with ease by a surgical operation, but this was out of the question, since her

¹ Case numbers refer to the record of the Gynecological Department of the St. Louis Polyclinic.

nervous condition, the weakness of her heart, and the dangerous symptoms previously experienced, forbade the use of anæsthetics, and without these she feared any interference, dreading the thought, and the effect of pain. I was at a loss what to do. I sought to relieve the displacement, to check the menorrhagia by the use of astringents, to contract the uterus and expel the growth by faradization and the persistent use of ergot; while I succeeded in alleviating the symptoms, in stopping the flow, in forcing the growth down lower, I could neither reduce nor remove it.

Finally I resorted to negative electro-puncture, and after three treatments, of five minutes each, every third day, the tumor completely disappeared. The large plate was used in connection with the positive pole as the large dispersing electrode, 6" by 9", upon the abdomen, and the platinum stylet attached to the negative pole was inserted into the presenting portion of the polypus; a current of 90 milliampères was used for five minutes; with gentle pressure upon the active pole the stylet gradually bored its way as the surrounding tissue yielded to the destroying agent. A mass of yellowish-white froth surrounding the electrode, which was removed from vagina and os uteri, and an application of a 10-per-cent solution of carbolic acid made for antiseptic purposes; the parts were then carefully dried, dusted with iodoform, and tampons of alum cotton inserted to replace the uterus and contract the tissues.

During the following days shreds of disintegrated tissue and some pus was passed; upon the return of the patient, upon the third day, I found the growth smaller by half an inch. So it was reduced after each sitting, and when the patient returned three days after the third treatment no trace of the growth remained. No pain was experienced in utero, and the burning caused by the abdominal plate, sufficient only to cause a slight temporary redness of the skin, was easily borne. The constitutional effect of the treatment was exhilarating, causing an improvement in the circulation, as evidenced by the slight flush of the face and the glow experienced. After a rest of half an hour in the office the lady returned to her home in her carriage, feeling no unpleasant effects from the

application beyond a certain weakness, notwithstanding her debilitated condition.

After the removal of the growth the uterus was contracted by utero-abdominal faradization, and bipolar, intra-uterine galvanism; the hyperplasia was reduced by negative electro-puncture into the indurated tissue, and the organ replaced by astringent tampons, which also served to contract the tissues, for which purpose vaginal and abdomino-vaginal faradization was likewise employed. One year later I had the pleasure of seeing this lady upon her return from a summer in the mountains, restored to health, free from all cardiac symptoms, from back-ache, bearing-down pains, or pressure upon the bladder.

This was one of the most striking cases which has come under my observation, and one which I have frequently cited as an evidence of the benefits of electro-therapeutics. Had we not had this remedy, relief would have been impossible, and by the electric current the growth was destroyed, she was permanently relieved by a few office treatments, and not even confined to her bed. All the aggravating neuroses and annoying uterine conditions were overcome by the use of the galvanic and faradic currents in those various forms; the neoplasm was destroyed by negative electro-puncture of the mass; the hyperplasia reduced by negative electro-puncture of the uterine tissue; the uterus contracted by intra-uterine or bipolar galvanism and utero-abdominal faradization; the supporting tissues, ligaments, and vaginal walls strengthened and contracted by vagino-abdominal faradization. The dry treatment, with medicated cotton tampons, alone aided in the reposition of the uterus and the contraction of the tissues. No case could possibly better illustrate the various objects to be accomplished by a judicious use of electricity.

II. Absorbent, alterative and stimulating, catalytic effect. The interpolar action of a current between non-metallic electrodes, of which the negative is the smaller and active.

CASE IV. *Uterine fibro-myoma*.—Mrs. R., a lady of fifty, past the menopause, was afflicted with a large fibro-myoma, which had remained stationary for many years, of about the size and shape of a uterus in the fifth month of pregnancy. She was

much weakened by the almost constant flow which persisted ; this was relieved by curetting and the application of perchloride of iron to the cavity ; the tumor was somewhat reduced, and the annoying nervous symptoms relieved, by vagino-abdominal galvanism combined with the use of ergot. The negative pole, a cotton-covered ball electrode, was placed directly against the mass of the tumor in the anterior *cul de sac*, and the current dispersed at the positive pole by the large abdominal plate 6"-9". This treatment was continued for two months, every second or third day, in sittings of five minutes, with an intensity, as I now know, of from 30 to 40 milliampères. I will say that at the present day I should have taken more active measures, and resorted to negative electro-puncture, after having stopped the metrorrhagia by positive electro-cauterization (the positive metal electrode in the uterus), but this was three years ago, before I had ventured upon such energetic methods. The treatment was successful as a palliative measure ; the tumor was reduced two inches in height, which may have been in part due to the action of the ergot, and the hemorrhage, which had continued off and on for ten years, was permanently checked. I cite the case because it has been the popular method of treatment, and one from which good results have been gained by persistent efforts ; as I heard, for instance, from Dr. Reamy, of Cincinnati, who tells me that he has succeeded in reducing a uterine fibroid by one third. I would advocate this only in case that other methods should for certain reasons be impracticable, and then in combination with other treatment.¹

CASE V. *Ovarian sarcoma with perimetritis*. — Mrs. G., brought to me by Dr. McClintock, from Topeka, Kansas, is certainly a remarkable evidence of the absorbent effect of the galvanic current. The patient was referred for removal of the tumor by abdominal section. I saw her first on January 17, 1886, and found an adherent ovarian tumor, which I feared

¹ In speaking of the small plate as used for the dispersing electrode, I refer to one 4½ inches in length by 3¼ in breadth ; while the large plate used is 9¼ inches in length by 6¼ in breadth. The intermediary, 6¼ by 4½, is the one most universally serviceable : not so large but that it can be easily slipped under the clothing, and yet large enough to admit of the use of currents sufficiently strong for all ordinary purposes.

was malignant, combined with a localized peritoneal inflammation. The patient was emaciated, suffering from irritation, insomnia, constant pain, in fact, in a most miserable condition. My opinion as to the inoperability of the case was confirmed by consultants, but unwilling to return this lady, in whom her physician took a deep interest, to her home with such a gloomy prognosis and without relief, I resorted to the use of electricity—abdominal galvanism and faradism—the small plate being applied in the right iliac region, upon one side of the tumor, the large plate on the left side, over the site of the inflammatory mass ; a current of 45 milliampères was used for five minutes, and this was followed by faradism, by means of the same electrodes, for from five to ten minutes, with the use, during the first treatment, of a current of high tension for the purpose of relieving the inflammatory pains. Negative electro-puncture was tried through the abdominal walls, but not persisted in, since excessive pain was caused by intensities too low to be effective, 10 and 20 milliampères. Relief was at once experienced ; after the third application the abdomen had been reduced three inches in circumference ; after the fifth, five inches, and the patient left for her home after this treatment, on January 23d, relieved from her pain and filled with hope ; in the last three applications faradic currents of greater quality and less tension were used to contract. She slept well, ate well, and had regular motions of the bowels ; the agonizing pains had been completely relieved ; the long railroad journey to her home did her no injury. Dr. McClintock continued to use the galvanic current for a time, and under date of July 23d writes : “Mrs. C. has been gradually improving since last April, and has gained probably fifteen pounds in weight in the past four weeks. I did not use the battery more than twice during June, and the tumor grew gradually smaller ; even the hard portion of the tumor became soft, pliable, and movable, the uterus decreased in size, appetite became good and the patient felt stronger. Is it possible for our patient to recover ?”

Is this not a wonderful result ? A probably hopeless case ; a large adherent tumor combined with cellulitis, distending the abdomen to the size of a pregnancy at term, all functions fail-

ing ; medication attempted by a devoted attendant in vain ; a reduction in circumference of five inches, restoration of almost failing functions, after five short painless treatments !

III. Electrolysis proper. The destructive polar action of the metallic negative pole, combined with the absorbent alterative and contractile interpolar effect of the current.

This is the treatment applicable to all large growths which can be reached either directly by the metallic pole within their tissue, or, in case of uterine fibroids, within the uterine cavity. A current of from 100 to 250 milliampères is used for a period of from four to eight minutes, the active negative pole within the tissues. In these cases the treatment must be governed by the hemorrhagic tendencies of the tumor, often a prominent feature, and always one which first demands attention in uterine fibroids. The treatment preferable, regardless of these conditions, is by negative electropuncture : the passing of a strong stylet per vaginam into the mass of the tumor, to the depth of from two to three inches. This is connected with the negative pole, which is the active agent ; the current being dispersed at the positive pole by a large abdominal electrode. Some recommend the arming of both poles with pointed metal electrodes inserted into the mass of the tumor, either both per vagina, or one per vaginam, one through the abdomen.

If contra-indications do not exist, or have been regulated, the active negative pole in the tissue of the tumor itself is the most effective, and by the vaginal puncture is far more safe than that through the abdominal walls, as avoiding the peritoneum ; it is evident that this is the least painful method and the only one feasible without the use of anæsthesia.

Electrolysis proper is the typical treatment for the reduction of neoplasms, especially of uterine fibroids, in which we utilize both the polar and interpolar effect ; the polar action of the metal cathode within the tissues of the growth, the most useful chemical effect of galvanism, and the catelec-

trotonic action, that of the current emanating in concentrated form from this negative pole, as it passes through the tissue and is dispersed upon the opposite surface in the large neutral anode.

We may also puncture from both sides, using a penetrating needle in connection with both the positive and negative poles. This is admissible in external growths readily attacked from all sides. In the case of uterine fibroids, intramural or subserous, I consider negative electro-puncture per vaginam, through the tissue of the cervix if possible, by far preferable to puncture by both negative and positive electrodes through the vaginal and abdominal portion; I object to any puncture through the abdomen, unless the tumor be agglutinated to the parietes, on account of the most unnecessary danger and suffering which invariably accompanies this proceeding. The puncture of such a tumor through the cervical tissue, or even through the vagina, avoids the peritoneum and causes but very little pain. The current can be dispersed by a sufficiently large electrode upon the abdomen, so as to make the treatment very bearable and possible in the office, even if the highest intensities are used. If we puncture through the abdomen, an anæsthetic is necessary; the peritoneum and abdominal cavity are penetrated, and the danger of inflammation is at hand, as fluid is liable to exude into the cavity. This very serious risk accompanies the abdominal puncture in addition to minor dangers—such as the possibility of opening a large vessel—which we have equally in the vaginal puncture, but which seems to exist in theory rather than in practice, as I have seen no such results. The abdominal puncture assumes the dignity of an operation, necessitates anæsthesia, and offers no corresponding advantages over the vaginal method. Among the comparatively small number of operations of this kind performed, cases of peritonitis, perimetritis, and death have occurred. If bipolar electrolysis is desirable, this may be effected altogether through the vagina; but, as a rule, negative electro-puncture is advisable in preference to bipolar electrolysis—the insertion of both positive and negative nee-

dles into the tumor per vaginam—because the pain and danger is diminished by one half, one puncture being made instead of two.

In electrolysis an intensity of from 50 to 250 milliamperes may be used for from three to eight minutes. All possible precautions must be taken in the first sitting in order to discover any idiosyncrasy of the patient, and a current of 50 milliampères will suffice, attained by slow increase. The patient should lie down quietly for several hours after the application. If an intensity as high as 100 milliampères is used at the first sitting, it is preferable that she remain in bed for the first twenty-four hours, and a cold compress or an ice-bag be placed upon the abdomen, to overcome any tendency to inflammatory reaction which may occur, hence the attention to details which is necessary, and the precautions desirable in a first puncture, until the sufferance of the individual patient is tested. I have used as high as 250 milliampères in my office, allowing the patient to return home in the street-cars after an hour's rest; but such intensities must be attained only by gradual increase, and where we see any indication of inflammatory action the patient should remain in bed for a day or two, using the cold compress or the ice-bag. The application is repeated according to the demands of the case and the severity of the treatment, once or twice a week. Hemorrhage occasionally follows, sometimes soon after the treatment, sometimes not until six or eight hours have elapsed. This may be either from the uterine cavity, the fluidifying effect of the negative pole, or from a larger vessel in the line of puncture, which has been temporarily closed by cauterization during the action of the agent.

On account of the hemorrhagic tendencies of the negative pole, this treatment is only applicable in cases unaccompanied by hemorrhage—a frequent symptom of uterine fibroids; if scanty menstruation, dysmenorrhea, or profuse discharge be present, negative electro-puncture, though not contra-indicated, should be preceded by negative electro-cauterization of high intensity; the uterine sound attached

to the negative pole within the cavity, the large plate of the positive dispersing electrode upon the abdomen: we thus achieve an absorbent electrolytic action upon the tumor, though in a less degree, and overcome the co-existing symptoms, favoring an increase of the catamenial flow, overcoming the endometritis, relieving the dysmenorrhea, if any exist. An intensity of from 50 to 100 milliamperes should be used, or even 150 and 200 milliamperes, if decided action on the fibroid is desired.

In fibroids accompanied by menorrhagia or metrorrhagia, this must be first overcome by positive electro-cauterization of the uterine cavity: a platinum sound as the positive pole in the uterus, the large negative dispersing electrode upon the abdomen. It must not be forgotten that when a metal electrode is used in connection with the positive pole in the tissues it must be of platinum or gold, lest it be corroded and imbedded in the organ. If high intensities be used, this is an absolute necessity; let this be remembered as being applicable to the treatment of all possible affections. If the ordinary silver or copper probe be used in the uterine cavity as the positive pole, and a current of only 10 to 20 milliamperes is passed, the instrument will be found fixed; and when we attempt to withdraw it after a few minutes, some force is requisite for its removal; if we then examine it, we find the surface corroded, roughened, and darkened. This is due to the action of acids which accumulate about the positive pole. Should, by some oversight, a corrodable metal be used in this way, the current is gradually reduced and reversed, and, after a negative current of greater strength has been passed for a time, we can then withdraw the sound with ease. In case of hemorrhagic fibroids, the positive electro-cauterization of the uterine cavity with the platinum sound, with a current of from 100 to 150 milliamperes, should precede electrolysis proper or negative electro-puncture, until all unusual flow has been overcome. In the treatment of fibroids where the highest intensities are used, we must apply the electric current with the utmost circumspection, taking into considera-

tion all the accompanying conditions, those most to be guarded against being hemorrhage and inflammation.

Method of application.

I will briefly recall what I have already said as to the method of application, since attention to the minutest details is necessary to success and to the comfort and safety of the patient. The consent of the patient must of course be obtained, as in case of any operative interference, and she should be given an idea of the treatment, that she may not be nervous and restless, but remain perfectly quiet during the action of the remedy. She may be promised that she will receive no shock, which embodies the idea of electricity to the laity, and is what ladies most dread; she can be assured that she will suffer no unbearable pain; that she will experience no discomfort whatsoever within, but that there will be a burning—not excessive—outside upon the abdomen. The corset is removed, the skirts loosened so that respiration may be free, and the abdominal plate, warm and well moistened in simple hot water, is snugly adapted. The patient takes her place upon a gynecological operating table or chair, in the dorsal decubitus, the thighs flexed precisely as for ordinary treatment. The electrodes needed are a gold or platinum sound of ordinary dimensions, and a needle or stylet of the same material (though the steel instrument may be used), well fixed in a firm handle; for puncture through the vagina, this instrument should be of a length equal to that of other gynecological instruments, sound or applicator; for both sound and stylet we must have a separate insulator of heavy rubber—better still, of glass, which may be kept more thoroughly aseptic. The abdominal or dispersing electrode is a thin plate of lead or tin alloy, as large as it can be used upon the abdomen, averaging six by nine inches, covered with a thin layer of sculptor's clay, held in place by gauze, or with punk or absorbent cotton and a soft, thin buckskin cover, which is equally good.¹

¹ Apostoli lauds the sculptor's clay as superior to all others. I am using the punk- and buckskin-covered plate, and have attained equal success. I have

The shape which admits of the use of the largest possible plate is the oval, or, better still, the modified form of my plate, oval with convexities to avoid the thighs. This electrode is thoroughly soaked in water as warm as is comfortably borne,¹ and snugly adapted to the abdomen, that it may rest in place a few minutes before treatment is begun, the current then passing more readily, with less pain; the friction, as I may say, caused by the efforts of the electric current to pass the resistance offered by the dry epidermis being possibly a source of pain, certainly lessening the effect of the current by loss of intensity in overcoming the greater resistance. If this precaution is not observed, the operator will find an intense burning during the first few minutes, which lessens, however, as the tissues become soaked; the desired intensity having been attained, notwithstanding that no more cells are inserted into the circuit, the galvanometer will indicate an increase in high intensities of as much as 10 milliampères, and yet the pain lessens decidedly if the positive be the dispersing pole. I have even seen it rise from 50 to 100 milliampères, without augmenting the number of cells, when the abdominal plate had not been placed until the last moment, so that the dry epidermis offered a resistance at first difficult to overcome. In other words, when the epidermis becomes soaked, less resistance is offered, more electricity passes, and if the positive be the dispersing pole the pain is lessened by the anæsthetic effect of the pole, diminished at times to a minimum, though the intensity of the current be increased. Before placing this plate we must examine the used equally high intensities, with a minimum of pain to the patient and no eschar. Since punk is difficult to obtain in this country in large sheets, absorbent cotton may be used; a thin, even layer of this, quilted smoothly under the chamois cover, makes as good a conducting electrode as punk or clay. The quilting is easily done with my perforated metal plates.

¹ Electrodes which offer so little resistance as these I recommend must be soaked merely in hot water, salt should not be added, since it injures the electrode, and does not add sufficient to the conducting powers of the instrument to counterbalance the accompanying disadvantages—greater burning, especially on mucous surfaces, and destruction of the electrode by electrolytic action upon the salt solution.

abdomen to see if it shows any abrasions or excrescences; if so, they may be covered with a small piece of oiled silk or plaster, as such a spot would be the center of intense pain if not guarded. An abrasion, a small blister where the epidermis is removed, centers upon itself much of the electric force, which always seeks the best conductor; or if an excrescence the increased pressure would cause a concentration of the current at this point. The plate having been placed, it is covered by a warm, dry towel, or a piece of oiled silk, to guard all garments in contact with it from moisture, which may lead to serious colds, to injury as well as mere discomfort.

The stylet or sound, whichever is to be used, is steeped in a strong antiseptic solution, as is also the glass or rubber insulator; the vagina also should be cleansed. For electro-cauterization the sound, covered up to two inches of the point by the insulator, is introduced into the uterine cavity with the utmost care; if possible it is preferable to introduce the sound by the sense of touch. If the stylet is used for electro-puncture, the point of entry having been carefully decided upon, the instrument is introduced, the point guarded by the index finger of the left hand, the handle grasped firmly by the right, counter pressure being made upon the abdominal protuberance. The puncture is then made for a depth of from one to three inches, according to the size of the tumor, the insulating cover is moved close against the vaginal and cervical membrane, and care must be taken that the entire surface of the instrument not in action is guarded. The activity of the battery is now tested, the rheophores are attached to the electrodes and the screws firmly bound; the galvanometer-needle must point directly to zero. The abdominal plate, evenly adapted everywhere, is held down with gentle pressure by the hands of the patient, while the operator either fixes the sound or stylet with an absolutely steady hand, or rests it upon some suitable support, as the slightest motion, any jarring of cords or battery, in portable batteries, must be avoided. The patient must breathe

evenly and steadily, and allow her hands to follow the respiratory heavings of the abdomen; we must see that the thighs nowhere touch the edge of the electrode, and if perchance the probe is to be passed through a speculum the slightest contact of its metal surface with the pole must be avoided. When any pain or discomfort that may have been caused by the introduction of the instrument has ceased, the current is established and gently increased, in the first sitting, in the course of a minute up to 50 or 100 milliampères; later when the sensibilities of the patient have been tested 150 to 200, and even 250 milliampères may be attained in the same time. For very sensitive patients I use the water-rheostat, by means of which we can attain the desired intensity, increase and diminish the current without even the slight shock caused by the addition of element after element; a resistance of 500 or 1,000 ohms are inserted, the number of cells probably needed thus brought into action, and the intensity gradually attained by decreasing the resistance in the rheostat; for the breaking of the current the resistance is increased until it surpasses the intensity of the elements in the circuit.

The first sitting should not be continued beyond five minutes, the current remaining at its height three minutes, then being slowly reduced. Currents of 200 milliampères I have continued for eight minutes in later stages of the treatment. During the passage of the current the operator must constantly observe both his galvanometer and the patient. The needle should remain perfectly steady: during the first minute it will show an increase of a few milliampères, but there must be no oscillation which indicates jarring or shock. The face of the patient and the galvanometer must be constantly observed, and the operator must be on the lookout for any evidence of irregularity: a momentary contact of sound and speculum would produce a terrific shock. If the bare sound should touch the vaginal membrane it would burrow its way and leave a grayish bed; if the thighs touch the edge of the abdominal plate, which must always be covered by the overlapping conductor, an intense burning is experienced; if not

so covered, a shock ; and these shocks are trying if not dangerous with such intensities. The most intense shock is caused by a carelessness, of which no one who ventures upon this treatment should be guilty, the sudden breaking of any one of the connections in the circuit, the dropping of the rheophore from the binding post at the battery or from the electrode, or the moving of one of the switches of the battery. In a portable battery, especial care must be taken lest disturbance be caused, the slightest jar of the battery causing undulations of the current and shock. At the point at which the stylet is inserted, a grayish-yellow foam will accumulate, its mass depending upon the intensity and duration of the current.

After the full intensity has been attained and continued as long as it seems necessary, the current is slowly reduced from cell to cell, with the utmost evenness and gentleness, and the circuit opened when at 0. If the patient be very sensitive we may diminish the current by slowly increasing the resistance by the water-rheostat. When the current has been broken the rheophores are detached and the active inter-pelvic pole is first removed, with the utmost caution ; the abdominal plate is then taken off, the speculum inserted, and the vagina cleansed.

I am in the habit of dusting the cervix with iodoform, and inserting a tampon of salicylated or borated cotton ; in case of puncture I use the styptic iron cotton directly upon the point of attack, and pack it firmly to counteract the possibility of hemorrhage as far as possible. The patient should then lie down or go to bed, if at her home, and if not, as soon as she reaches it ; but in all events she must rest in the office long enough to thoroughly dry her garments, which are more or less moistened by contact with the electrodes, notwithstanding all care, in cold weather this precaution must be invariably observed, as serious injury may follow neglect. A twenty-four hour's rest is generally all that is needed, but in individuals more susceptible it is well that they use the ice-bag upon the abdomen and remain in bed

several days. The inflammatory swelling, which sometimes follows, is thus best counteracted and most rapidly reduced; but even when it does occur, I have never seen it accompanied by constitutional disturbance or elevation of temperature.

The puncture should, if possible, be made through the cervix into the mass of the tumor; if the first is above the os, the next should be below, followed by one to the right and then to the left; if this is not well feasible, we seek the point of greatest projection, toward the vagina, avoiding the peritoneum. In some cases a gush of blood, very profuse while it lasts, but not of long duration, may take place within the ten hours following the application, and the patient must be forewarned, that she may not be alarmed. The firmly packed iron cotton tampon is the best preventative, but the hot-water injection should also be recommended, as the patient will be much better satisfied to have some means at hand to counteract this apparently threatening symptom.

I have entered so fully into the mechanical details of the treatment to recall them distinctly to mind, as they are absolutely essential in these cases, and will serve as a guide in all other applications, and once understood I need not enter again and again upon the same points.

We must always warn the patient of what is coming; we must first apply the dispersing electrode to the abdomen, thoroughly moistened with warm water; we must have the intra-pelvic electrode aseptic, and introduce this with the greatest possible gentleness; we must thoroughly insulate all but the active portion of the instrument, avoiding metallic contact with vagina, vulva or speculum, and never establish the current until all intra-pelvic disturbance has ceased, always increasing the current very gradually, avoiding all pain at the site of the active pole, bearing in mind this most important and invariable law in gynecological electro-therapeutics that *the intra-uterine or intra-pelvic pole must never cause pain*; in fact, *should not be felt*; upon the site of the abdominal dispersing pole the burning can be lessened by increasing the size of the electrode. All shock must be

avoided; the connections made before the current is established, and not severed until after it is broken.

CASE VI. Mrs. V. (No. 123). *Uterine fibro-myoma with menorrhagia, retro-uterine hematocoele and left cellulitis.*—The hemorrhagic state of this case, the existing inflammation which was active, subacute, contra-indicated electrolysis or negative electro-puncture. To check the hemorrhage, positive electro-cauterization was resorted to, the platinum sound connected with the anode in the uterus, the large dispersing cathode upon the abdomen. At the first sitting a current of 60 milliampères was used for eight minutes, no stronger current being admissible on account of the existing inflammation. The effect was good, hemorrhage and pain lessened. Two days later the treatment was repeated, 100 milliampères used for six minutes; bleeding, which had been almost constant, was stopped. After three further treatments upon alternate days, the menses appeared: previously profuse, now normal in quantity. This symptom being overcome, the inflammatory conditions were attacked by vagino-abdominal galvanism; the negative pole, a large metallic ball covered with absorbent cotton, moistened in warm water applied per vagina, the large plate in connection with the positive pole upon the abdominal surface of the exudation. From 40 to 60 milliampères were so used, serving to relieve the pain. Hemorrhage and excessive suffering being overcome, the patient was ordered to bed at her home, and directed to continue the use of poultices and hot-water injections until more active measures could be taken for the destruction of the tumor.

CASE VII. Mrs. K. *Uterine fibro-myoma (bilobar)* extending to one finger's breadth above the navel.

First tentative treatment, May 2d: negative electro-puncture; small stylet introduced to the depth of 3 centimetres; 80 milliampères for five minutes.

Second puncture, May 5th: large platinum stylet introduced to the depth of 4 centimetres; an intensity of 100 milliampères for five minutes; no pain was experienced from the internal electrode, and the abdominal burning diminished greatly toward the end of the sitting.

Third sitting, after an easy menstrual period, May 12th : 80 milliampères, six minutes ; highest portion of the tumor $3\frac{1}{2}$ centimetres below the navel.

Fourth sitting, May 24th : 60 milliampères, eight minutes ; large stilet introduced to the depth of 7 centimetres ; highest portion 5 centimetres below navel.

May 31st, notwithstanding that a current of only 60 milliampères had been applied on account of insufficiency of the battery, local pain followed, the tumor enlarged in circumference, extending above the navel, became tense, swollen, apparently fluctuating ; no rise of pulse or temperature. Treatment deferred.

June 2d, fifth treatment : 50 milliampères, six minutes ; tumor harder, less elastic, much diminished.

June 7th, sixth treatment : large stilet, 8 centimetres, 60 milliampères, seven minutes.

June 15th, seventh treatment : 60 milliampères, ten minutes ; tumor very hard, extending half way to umbilicus ; pelvis, which had at first been almost full, more free ; vagina, which had been a fan-like expansion, now assuming more normal proportions. Ice-bag immediately after treatment, since it had answered well when applied during the apparently inflammatory enlargement. The patient returned to her home after the ninth treatment greatly improved in health, functions re-established, the tumor reduced very much in size. Each of the nine sittings had lasted from five to ten minutes.

I will state but one more case showing some points of difference.

CASE VIII. Mrs. K. (No. 58). *Uterine fibro-myoma*.—General debility, scanty menstruation. Patient aged thirty-two. A fibro-myoma, similar to the last, filling the pelvic cavity, its left half extending to the height of the navel, the right an inch and a half lower, the uterine cavity possessing a depth of 13 centimetres. This tumor, which had been first noticed in November, 1885, had been rapidly growing, notwithstanding active local and constitutional treatment, mainly with ergot, at the hands of one of our ablest gynecologists, first came under my observation March 9, 1886, recommended

to me by her previous attendant, my esteemed friend Professor Boisliniere.

April 28th, first tentative treatment ; the puncture made with a small stylet ; a current of 45 milliampères was used for five minutes. Treatment was continued once a week, the puncture hereafter being made with a large platinum stylet through the cervical tissue, and the prominent vaginal projections of both right and left masses, which were punctured to a depth of from 7 to 8 centimetres. For the six treatments following the first, a current of from 100 to 110 milliampères was used ; then a still higher intensity, from 160 to 200, was applied. The burning, occasionally intense, often decreased to a minimum toward the end of the sitting (by reason of the anæsthetic effect of the positive pole), the punk- and chamois-covered plate being used, leaving the abdomen, after its removal, sometimes slightly reddened but always cool. This patient, feeble, subject to fevers, at first did not improve constitutionally. The tumor, after the third puncture, was 3 centimetres below the navel on the left side, 4 on the right—the pelvis more free, a most decided shrinkage, due, I presume, in part to the powerful contraction caused by the high intensity used. In this case free bleeding followed several of the applications, from one to six hours after treatment, after the fourth puncture ; coming at one time when still on the table, checked with considerable difficulty by iron cotton tampons. By June 28th the tumor seemed again to increase ; her general condition not having improved, menstruation still being excessively scant, a mere show, I endeavored to further constitutional improvement, using no internal remedies, as she complained of her stomach which had been ruined by constant but ineffective medication : electrolysis was stopped, and negative electro-cauterization resorted to for the purpose of increasing the flow. The uterine cavity then measured 11 centimetres.

July 1st, negative electro-cauterization ; 100 milliampères, six minutes. July 12th, 100 milliampères, eight minutes. July 16th, 150 milliampères, ten minutes, no discomfort whatsoever being experienced from the intra-uterine negative pole.

August 6th, menses free, continuing five days ; more profuse and better than ever before since first established ; she

has gained $3\frac{1}{2}$ pounds in the last month ; looks much better ; feels well. This treatment was continued, with interruptions, during the summer ; menses more free than they had been for years ; her general condition much improved. No medication whatsoever was resorted to.

I have cited examples of such cases as are most striking, and most difficult to reach by any other method of treatment—subserous fibroids. In smaller sub-mucous and intra-mural tumors the treatment varies ; we use negative electro-puncture for the purpose of reducing the tumor, and at times, especially near the period, the electric current gives rise to powerful and painful uterine contractions, which are very desirable if the growth is of such a kind as to make expulsion possible. If this be not the case, however, these contractions may render the treatment impossible ; as in a lady suffering from a large sub-mucous, intra-uterine, fibro-myoma, in whom positive electro-cauterization for the relief of menorrhagia caused such violent contractions that opiates were called for ; after cessation of the menses treatment was resumed and no contraction caused. If the tumor is small, we may even seek to further these contractions by strong utero-abdominal faradization, with currents of low tension and quality ; a single application causing more active muscular contraction than the administration of ergot for months ; where expulsion may be expected from this drug, it can be obtained with greater certainty and greater rapidity by the electric current.

The galvanic treatment of fibroids varies greatly with the nature of the case ; wherever the uterine muscle is small and the cavity empty, the secondary, contractile, action can be disregarded, but in intra-uterine tumors it is an element of sufficient import to determine the method of treatment ; the contraction caused by strong galvanic currents is of therapeutic advantage as it contracts the vessels, cuts off the supply, and serves to reduce the neoplasm by starvation ; but if contraction is caused in a powerful uterine muscle it may give unnecessary pain.

II.

Chronic pelvic inflammation with induration and extravasation; para- and peri-metritis.

In the treatment of these diseases electricity takes an important place, since they are deep-seated, affecting parts entirely inaccessible, beyond the direct reach of local medication, and but little affected by internal remedies; often latent and concealed, yet most persistent, and for this very reason the most aggravating and annoying of the many afflictions which undermine the nervous and physical organization of woman; it is here that the penetrating power of this subtle fluid, the current proper—the interpolar effect—is utilized to its best advantage. Not that I would recommend electricity to the exclusion of other means for the treatment of para- and perimetritis, but I would urge the importance of the galvanic and faradic current as at least equal to that of all other local and constitutional remedies, and perhaps effective in a greater class of cases than either of the other two; it is an agent to which we may look for results in the most desperate or tedious cases, where everything else has failed.

Electricity is most beneficial and effective in those lingering, latent cases which have continued for years, made evident by no distinct symptom, revealed only by constitutional debility, nervous prostration, pains in the side, and exacerbation with overexertion or colds, while a physical examination shows nothing but a thickening of the ligaments, with some contraction, and possibly an induration of the cellular tissue. More striking are the results which follow its use in large, more or less inspissated, pelvic effusions; in the former it is the absorbent and alterative catelectrotonic action of weak galvanic currents, with stimulation of vasomotor and trophic nerves, and stimulation or sedative action of mild faradic currents; in the latter, the electrolytic effect of the negative pole, with a powerful galvanic current.

In the treatment of these pelvic inflammations we utilize

the absorbent, the electrolytic, the sedative and stimulating properties of electricity.

Faradism we use for its sedative properties in acute conditions, and in subacute and chronic cases accompanied by pain; the desired effect is obtained by currents of high tension (a long secondary coil of very fine wire with frequent interruptions, 2,000 to 3,000 per minute) applied with the cotton-covered ball electrode per vaginam, and the small or medium plate over the abdominal site of the inflammation. In subacute or chronic cases without pain, we use the faradic current as a stimulant to improve the circulation and to promote functional activity, and thus indirectly further absorption; this is done by a current of less tension and greater quality (a shorter secondary helix of medium, and only in non-responsive cases of heavy, wire, with from 1,000 to 2,500 interruptions per minute). It is applied in the same way, and where the inflammation is in the immediate vicinity of the uterus, or this organ is imbedded in the inflammatory mass, the intra-uterine or bipolar application is preferable to the vagino-abdominal; that is, either by the electrode of Apostoli, which places both negative and positive pole within the uterine cavity, or by my own, which places one pole against the cervix and the other at any desirable point within the uterine cavity; powerful currents can thus be applied, and their effect confined within narrow limits.

The galvanic current is used for its absorbent and electrolytic qualities; desirable in those marked chronic cases which so often escape observation, yet produce such widespread depression. A cotton-covered ball electrode is placed against the vaginal site, connected with the negative pole, unless it be for some reasons desirable to utilize the anodine effect of the positive pole with a weak current, the dispersing pole, mostly with the medium-sized electrode, over the seat of inflammation upon the abdomen, and currents of from 20 to 80 milliampères; sittings of from six to ten minutes every second or third day. Local or reflex nerve symptoms are overcome, and absorption promoted by dilatation of vessels,

increased activity, and osmosis. The electrolytic action of the galvanic current is the most important, however; the negative pole is applied either in the uterine cavity, or, in case of effusion, by puncture within the mass itself; the treatment being accordingly a negative electro-cauterization of the uterus or a negative electro-puncture of the mass, the positive dispersing pole always resting upon the abdominal surface over the effusion; a current of from 100 to 200 milliampères is used from four to six minutes, twice a week if cauterization be practiced; once every week or two if puncture be resorted to.

We utilize mild electric currents, galvanic and faradic, to relieve pain in acute or chronic conditions; to stimulate activity, promote circulation and thus further absorption, or strong galvanic currents to promote rapid dispersion, and absorption direct, by electrolysis: The non-metallic positive pole for its anesthetic properties, the metallic negative pole for its stimulating and alterative tendencies. The results are often marvelous; pain which narcotics can not relieve is eased in a sitting or two; large indurated masses which have confined the patient to her bed for months are dispersed, more correctly their absorption is inaugurated, by four or five treatments of five or six minutes each; and these are results which I have attained in cases that have resisted prolonged efforts at treatment at the hands of the ablest physicians. Let it be remembered that I do not advocate reliance upon this agent alone, nor that we should seek to accomplish a complete cure without resorting to other means, but that it is an important factor in the treatment, indicated in certain conditions or at certain times; the beneficial results appear *at once*; if not during the sitting, soon after; we need not wait for weeks before an effect is visible. The use of electricity interferes in no way with any other method of treatment, hence it does not exclude the usual remedies, but hastens their action; it relieves pain rapidly, and promotes healthy, physiological processes, since in these cases it reaches the site of inflammation more directly than any other means. In some almost

hopeless cases it is our main stay ; in others, it is only one of various means adopted ; sometimes we use it only to overcome one symptom or another.

Positive rules can hardly be laid down for the treatment of pelvic peritoneal, and cellular inflammation by electricity, since it displays such varied forms, but I will cite in illustration a few cases exemplifying typical forms to indicate the methods of therapeutic application. It will be readily seen that, for the purpose of effective treatment of the different forms of this disease, a thorough knowledge of the various qualities of the electric current and its judicious application is necessary, that we may not injure where we expect to benefit. Were we to use a faradic current of quality instead of tension, the short coil of thick wire in place of the long coil of thin wire, for the relief of pain in acute or subacute perimetritis, the suffering would be aggravated ; were we to resort to negative, in place of positive, electro-cauterization in a case of effusion, accompanied by hemorrhage, this would be increased and the patient endangered.

CASE IX. Mrs. E., aged 30. *Chronic perimetritis, left.*—Anemic, sterile ; suffering more or less since her sixteenth year from a severe cold then taken ; uterus normal. Examination under anæsthesia alone reveals the thickening of the ligaments and the tube on the left side ; a slight overexertion, or exposure to cold, aggravates the symptoms and causes pain in the side ; a characteristic case of this deceptive veiled form of chronic perimetritis. Application of iodine to the cervix and vaginal vault, hot-water injections, blisters, iodine externally had been tried ; the hot douche was constantly used ; tonics, mainly iron, quinine, and nux vomica, were given. Improvement, though visible, was slight and slow, until I resorted to the use of electricity, by which a marked change was produced.

In this chronic form, the absorbent effect of the galvanic current, and the stimulating action of the faradic of greater quality and less tension was used. More rapid progress was visible after I had thus replaced the previous treatment ; evident improvement followed each application in so far as the

feelings of the patient were concerned; she felt better; experiencing a pleasant general as well as local effect, and her left side felt better, less heavy, less sensitive; not so easily wearied by exertion. The galvanic current, vagino-abdominal, negative pole, cotton-covered ball electrode in the fornix to the left of the cervix, small plate in the left iliac region; 20 milliampères, eight minutes; from 20 to 40 milliampères were used in sittings every second or third day during the course of two months. In every third or fourth sitting the faradic current was used in the same way, vagino-abdominal, moderate quality and intensity, in place of the galvanic; the improvement was more evident, more satisfactory, than that which had followed any other method of treatment.

CASE X. *Chronic left parametritis, with metritis, menorrhagia, and endometritis membranacea.*—More recent, more active than the last. The uterus was laterally flexed and dragged over by the existing adhesions, a knuckle was formed in the canal, the tissue was so firm and the menorrhagia so profuse, that the previous attendant had diagnosed a fibroid, aggravating the suffering by his treatment. The patient was very weak, debilitated, excessively nervous; vagino-abdominal faradization of high intensity; frequent interruptions for the relief of pain. The first sittings lasted only four minutes every other day, and afforded decided relief, the first she had experienced; iodoform and iodine-cotton tampons completed the treatment. This was continued for two weeks, then positive electro-cauterization of the uterine cavity was resorted to for the purpose of overcoming the menorrhagia, beginning with 15 milliampères for four minutes; at the second sitting 20 milliampères; at the third, 60 milliampères were used; the menses coming on after the fourth treatment, less profuse. During the next month the positive pole was replaced in the uterine cavity by the negative; negative electro-cauterization being used at first 60, later as high as 120, milliampères; the excessive discharge from the endometrium was diminished, the fundus approximated to the median line, the tension and induration of the ligaments and adhesions lessened. As the menstrual period approached, positive electro-cauterization was again resorted to; as a precaution, I kept the patient in bed, and the flow was

still less, the period passing over without the usual suffering and prostration. Rapid improvement followed.

CASE XI. B. J. (colored). *Acute cellulitis, with menorrhagia and pelvic effusion.*—Completely prostrated, blanched from loss of blood; suffering from profuse menorrhagia with constant flow; came to the gynecological department of the polyclinic in the fourth month of an acute cellulitis. Case similar to the last, but more active and more recent; menorrhagia continuous; circumscribed effusion, the size of a child's head, in the left iliac region. Entered November 10, 1885, bleeding profusely, faint, exhausted. Positive electro-cauterization 50 milliampères, six minutes; iodoform and iodine-cotton tampon; perchloride of iron ten per cent was applied to the cavity, and the flow decidedly lessened. After the third treatment, in which the intensity had been increased to 80 milliampères, and medicinal applications stopped, the menses appeared less free. During the following month the treatment was continued, varied occasionally by bipolar intra-uterine faradization with a current of high tension, fine wire coil, frequent interruption. The menorrhagia had been overcome; general health and appearance of the patient had greatly improved; life and color returned to the face.

January 5, 1886, the second menstrual period since the inauguration of treatment, November 10, 1885, made its appearance; absolutely normal in quantity, without any pain; a slight discomfort being the only evidence of the flow. After this, hemorrhage being no longer feared, negative electro-puncture was resorted to to promote absorption, with the platinum needle in the tissue of the uterus to the depth of two inches, the large plate over uterus and effusion; 80 milliampères for five minutes at the first sitting. This was repeated every other day, the large stylet being used in place of the needle, and the intensity of the current increased to 100 milliampères. January 12th, the following entry is made: the patient in good physical condition; the effusion greatly reduced.

Since all inflammatory symptoms—pain and hemorrhage—had ceased, less attention was paid to the patient amid the great numbers in attendance, as she was in perfect condition, and vagino-abdominal galvanism was used, with from 40 to 80 mil-

liampères, for from six to eight minutes. March 28th, the case-book records the entire disappearance of the effusion; the fundus retroverted and dragged somewhat to the left.

CASE XII. Miss K. *Acute cellulitis* from want of care after destruction of uterine myoma by electrolysis; being obliged to work hard in very severe weather, she was attacked by an acute left perimetritis. Patient was attended at her home by Dr. Ameiss, of my clinical staff; febrile symptoms were overcome; no effusion developed, but the excessive pain did not appear to yield to the most active efforts of the attendant. Hot douches, blisters, poultices, were all tried in vain; even opiates gave her but temporary ease; in the second month of the disease the patient was brought to the clinic, and relief was experienced after the first application of galvanism, a negative electro-cauterization of 20 milliampères, six minutes; the uterine sound connected with the negative pole in the uterine cavity, the small plate upon the abdomen. After the second treatment, two days later, pain completely disappeared. Endeavoring now to stimulate, vagino-abdominal faradism was applied, but at once caused a re-appearance of pain, which was again relieved by galvanism; this treatment was continued, and later faradism was again tried for the sake of experiment, with the same result. It was evidently one of those cases in which an idiosyncrasy exists, although I must say that, whereas a faradic current of high tension was here in place, the battery of the clinic admitted of no choice, and the coil of wire, of medium thickness, was one of too little intensity and too great quality, thus aggravating the pain and bringing it about after it had ceased.

This experience may serve as a warning, to caution the practitioner against the indiscriminate use of faradic batteries, and the use of one and the same imperfect apparatus in all cases.

If the battery is not supplied with the proper apparatus, its quality should be determined, and it should then be used for certain purposes only.

CASE XIII. Mrs. R. *Left perimetritis*, exacerbation of an existing disease in consequence of exposure to cold during

menses. Uterus enlarged, anteverted, fundus adherent to the inflammatory mass which occupies the left iliac region, distinctly felt per vaginam; hard, unyielding. Poultices, hot-water injections, and vagino-abdominal faradization, with currents of high tension, were used until pain had subsided. An incision did not seem warranted, as no fluctuation could be detected. February 10th, negative electro-puncture, the platinum stylet forced per vaginum into the center of the mass to the depth of two inches, the large abdominal plate being placed upon its outer surface; a current of 70 milliampères was used for five minutes; the patient kept in bed. No reaction followed. One week later the treatment was repeated, and a puncture made three quarters of an inch from the site of the first, but more toward the inner border of the effusion; an intensity of 120 milliampères was applied for six minutes. Same precaution observed. Five days later, a third puncture was made; on account of weakness of the battery, only 60 milliampères was used, but for ten minutes. The menstrual period passed with much less suffering, though somewhat more profuse than the preceding. During the following inter-menstrual period, four applications were made of from 100 to 150 milliampères from five to six minutes each, a slight slough appearing, and a certain amount of thick purulent discharge coming from several of the punctures. Poultices, hot injections, iodoform, and tampons of tannated cotton completed the treatment. As in the electrolytic treatment of fibroids, the vagina was cleansed, the instruments rendered thoroughly aseptic, and, after the withdrawal of the stylet, the parts mopped with a five-per-cent carbolic acid solution, thoroughly dusted with iodoform, and dressed with a tannated tampon. April 4th, the mass greatly reduced; general condition of the patient very much improved; menstruation normal; healthy action of the bowels completely re-established. The treatment is now changed, vagino-abdominal galvanism and bipolar or intra-uterine faradism alternating every other day. The negative pole of the galvanic battery is applied as a cotton-covered ball electrode per vaginam at the site of the previous puncture, while the positive pole is a large dispersing electrode which is placed upon the abdomen in the left iliac region, from 30 to 60 milli-

ampères being used for six minutes. The faradic current is used of moderate tension and intensity, two thousand interruptions per minute. May 3d, treatment discontinued, the hot douche and painting with iodine being ordered at home.

CASE XIV. *Diffuse perimetritis right and left.*—The abdomen distended, sensitive; induration, but no extravasation in the left side; endometritis; patient extremely hysterical; rectum excessively sensitive. The patient had been treated during the winter at the Female Hospital; bedridden most of the time; came with the statement that the only relief she had been able to obtain had been from applications with the faradic battery. In the month during which she remained under observation no apparent benefit was visible from medication or any of the applications resorted to, vagino- and utero-abdominal faradism alone giving relief, and although no very marked improvement was evident when I saw her last, June, 1886, and progress was slow, it was none the less sure. The change in her condition is best shown by the fact that the patient now comes, in the fourth month of pregnancy, greatly improved in health, for the sake of information with regard to her condition. The abdomen is but slightly sensitive; no trace of the intense suffering and persistent inflammation noticeable.

III.

Chronic metritis and uterine hyperplasia.

The reduction of induration and enlargement of the uterus, due mainly to chronic interstitial inflammation, is a tedious task when attempted by any other method of treatment, and we have none to compare in efficiency with the electric current, which is in fact the only reliable agent for the reduction of such induration; wonderful in its effects, since the application relieves in place of causing pain, as other active remedies do, and soon frees the sufferer from all the annoying neuroses which are liable to accompany the disease. We find this hyperplasia in connection with chronic pelvic inflammation; with endometritis, but most frequently as an accompaniment and resultant of large lacerations of

the cervix which are followed by endometritis as well, and it yields but slowly to the usual methods of treatment by reason of the impossibility of a direct attack. In the electric current we have an effective means of reducing this condition, more certain and more rapid than any other; that the result may be hastened, all means should be utilized, such as the painting with iodine, the use of iodoform, and iodine cotton tampons, to replace the uterus if necessary, thus furthering a healthy circulation and promoting absorption.

In chronic metritis and hyperplasia we utilize the absorbent and electrolytic properties of the negative galvanic-current and the chemical action of the negative pole; also the contracting and stimulating effect of the faradic currents of quality and low tension. These cases are frequently accompanied by a scanty menstrual flow and dysmenorrhea, hence the hemorrhagic tendencies of the negative pole are of service, as well as its electrolytic and cauterizing properties; the most effective treatment, if there be no contra-indication, is negative electro-puncture: passing a platinum needle into the indurated tissue parallel to the uterine canal, connecting this with the negative pole of the battery, placing the positive dispersing pole upon the abdomen, using a current of from 50 to 150 milliampères. The larger stylet may also be inserted, or four or five needles at a time, surrounding the os, all connected with one and the same negative pole. If amenorrhea, painful menstruation, or the narrowing of the canal, especially in case of endometritis, accompany the hyperplasia, it is, first of all, important to remedy these conditions, and cauterization takes the place of puncture; that is, the uterine sound connected with the negative pole is used in the cavity, while the positive pole is in connection with the dispersing plate upon the abdomen.

If weaker currents, from 40 to 60 milliampères, are used, electro-puncture of the uterus may be repeated every third day; the application of currents of from 120 to 150 milliampères should be from four days to one week apart, as they are accompanied by a slight destruction of tissue, which

at first leaves an open canal, but at the end of that time nothing but a slight depression in the cervical tissue at the point of puncture remains. If the first puncture is made above the os, the second should be below, the third to one side, thus penetrating the different portions of the organ. After four or five treatments of this kind, intra-uterine or bipolar faradization, with a strong current of quality, a short secondary coil of heavy wire should be used, with but four or five hundred interruptions per minute, for the purpose of causing muscular contraction, or *massage of the uterus*, as it were. It being desirable to center the effect upon the uterus, the intra-uterine application is preferable to the utero-abdominal method, unless it be not feasible for certain reasons. If there be other conditions co-existing, or if pain be a marked symptom, this application of faradism must be modified, and less quality and greater tension used, more frequent interruptions, and we must perhaps be satisfied with the utero-abdominal in place of the bipolar intra-uterine application.

Positive electro-puncture, the positive platinum pole in the uterine tissue, is to be tried only in case that a greater destruction of tissue is desirable, an open canal remaining, through which detritus is discharged. The positive pole is more liable to produce a slough; hence, unless peculiar conditions exist which demand this procedure, the negative pole is far preferable, on account of its electrolytic action, absorption is promoted in uterine and peri-uterine tissues, and the usually scant menstruation increased.

The negative pole is, as a rule, the active agent, notwithstanding the erroneous teaching of some authorities who prefer the positive pole, on account of the greater slough produced, and lose sight altogether of its inferior electrolytic and absorbent action.

CASE XV. Mrs. T., Case 50. *Uterine hyperplasia, laceration of the cervix and perineum, distressing neuroses.*—Cervix in the hollow of the sacrum; uterus low; active endometritis,

menorrhagia, severe dysmenorrhea, annoying neuroses, especially headaches, which are intense at the time of the menstrual period. The patient had been treated in one of the best-known European clinics; strong acids had been applied to the cervix and uterine canal, which was very much narrowed; the cervix an enormous, dense hard mass.

First examination, February 19th. The cavity was narrow and sensitive, so that medication was out of the question, hence electricity was resorted to to overcome menorrhagia and metrorrhagia, and relieve the neuroses. A delicate probe was introduced into the uterine cavity, connected with the positive pole of the battery, the small plate placed upon the abdomen over the fundus; positive electro-cauterization, 20 milliamperes for eight minutes; treatment was continued every other day. At the second sitting 60 milliamperes were used for five minutes, which sufficed to overcome the constant oozing. Iodoform and iodized cotton tampons followed the electric treatment, and the hot douche was used at home. Metrorrhagia was checked, and after the third application the menstrual period appeared, less profuse, with less suffering. After this, the treatment was again taken up, positive electro-cauterization from 80 to 100 milliamperes being used, with the large abdominal plate. The second menstrual period, March 29th, passed off without any pain and without any headache, not even that dizziness of the head which had accompanied the monthly flow for years. The uterine cavity was reduced from 7 to 6 centimetres in length, the discharge being improved, the cavity widened, the dysmenorrhea and menorrhagia overcome; negative electro-puncture was now resorted to, from 40 to 60 milliamperes being used every other day in eight consecutive sittings. The following entry was made at the end of this period: "Condition of the patient good, though still taking care of herself; no complaints; the uterus reduced, menstruation normal." The stimulating effect of faradism was now tried; currents of quality, low tension—what I would call a massage of the tissues. The bipolar intra-uterine application would have been preferable; but the cavity not being sufficiently large to admit the electrode, vagino-abdominal faradization was resorted to—one pole against the cervix, the other upon the abdomen over

the fundus. May 31st the patient was discharged, in excellent condition. The faradic treatment was repeated every other day, in sittings of from three to four minutes each. With regard to the puncture, I will say that at that time I used but 40 to 60 milliampères, hesitating to use as high as 120 milliampères. In ordinary cases from 50 to 100 should suffice.

Mechanical details of electro-puncture of the uterus.

I would recommend that all the precautions advocated in the puncture of fibroids be here observed; but, since we can not fix the uterus as we can a fibroid, by pressure of the hand upon the abdomen, I prefer to insert the needle or stylet through the speculum. The uterus is fixed by the bullet forceps, or vulcellum, if the former be not at hand, directly above the point of puncture, and the needle then forced into the tissue; but, since this is so firm that the ordinary platinum needle is liable to give, a somewhat heavier instrument is preferable; though I would hardly recommend the large stylet, as used in the fibroid and in cellulitic effusions, with which I have very frequently treated these cases, on account of the canal it leaves if higher intensities are used. Possibly the effect may be more rapid; this I am not prepared to say. According to the density of the tissue and the size of the uterus, the stylet for puncture may vary from the size of an ordinary needle to that of a No. 1 English catheter, which I call the small stylet, and a No. 4, which I call the large stylet and use in fibroids and parametric effusions. If an ordinary heavy needle be used, it should be inserted at least to the depth of one inch—best deeper. All accompanying symptoms must be carefully weighed before puncture is resorted to. An admirable device, but one rather difficult of execution, is to insert four or five needles at the same time into the cervical tissue in a circle about the os, all connected to the same rheophore. After four or five applications, massage of the uterus, the contraction and stimulation by the proper faradic current, will rapidly further the attaining of the desired end.

IV.

Chronic ovarian inflammation.

As in other pelvic inflammations, the electric current is one of the most satisfactory remedies in these deep-seated, inaccessible troubles, this being, in fact, the only agent which directly reaches the seat of the inflammation; it is the interpolar current upon which we here rely, and by this we can never accomplish the same results as in those cases in which polar action is possible, the much more powerful and more concentrated influence of the pole itself. In the treatment of ovarian inflammation, we utilize the interpolar current altogether, for its sedative, stimulating, or absorbent action, as the case may be. The oval or ball (cotton-covered) electrode, from half an inch to an inch in diameter, is placed as near as possible to the ovary against the vaginal wall, while the dispersing plate is placed upon the abdominal surface directly over the ovarian region. For the relief of pain, and in more acute cases, we use a faradic current, of high tension with frequent interruption, of moderate strength. In more chronic cases, especially those with induration, we use the galvanic current, applied in the same way; this we may use of comparatively greater strength, according to the individuality of the case, at from 20 to 80 milliampères. Ten to 20 milliampères have a sedative effect, if the positive be used as the active pole, and still promote functional activity and alterative action. If higher intensities are applied for their decided denutritive effect, a large abdominal plate is of course necessary, and a large vaginal electrode, well covered with absorbent cotton to guard against cauterization of the vagina. The instrument which I have heretofore used is the vaginal ball electrode, of the size of a cherry upon an insulated stem, too small for stronger applications.

Since we can not directly reach the part in question, the treatment does not give very rapid and decided results beyond relief from pain, which we will often find after the

first application or two. Very strong currents are not used; the sittings should vary, according to the individuality of the case, from four to eight minutes, and must be continued for weeks or months until the result is attained, but never to the exclusion of other methods, since all factors must aid in the struggle. Pain and nervous disturbances are generally relieved in a few sittings.

I will briefly append two histories, more to show the different qualities of the current employed to overcome the varying symptoms of individual cases; the treatment in general being that of a congestion or chronic inflammation accompanied by pain, as in a localized perimetritis, which often presents symptoms very similar to that of an ovaritis. I look upon the galvanic current as mainly effective for the purpose of relieving pain in chronic cases, an object often speedily accomplished; pain in acute cases is relieved by vagino-abdominal faradism, with currents of high tension. An actual improvement in the pathological condition is effected by overcoming congestion and inflammation through the contracting effect of the faradic current, or the absorbent influence of the galvanic in cases accompanied by induration.

CASE XVI. Mrs. K. *Anteflexion, metritis, and endometritis, chronic oöphoritis, right and left, with enlargement of the excessively tender and anteriorly displaced ovaries.*—For the relief of pain a mild vagino-abdominal faradic current of high tension was employed, the ball electrode, covered with absorbent cotton, being placed against the distinctly felt anteriorly prolapsed ovary per vaginam, the small plate upon the abdominal surface. For the relief of the metritis and endometritis, negative electro-cauterization was resorted to, the negative metal pole in the uterine cavity, the medium size abdominal plate over the ovary of one side or the other. The patient being excessively sensitive, only from 10 to 20 milliampères were used. This treatment was feasible only after the sensitive condition of all the parts had been relieved by the faradic current. Iodoform and iodine-cotton tampons for the support of the heavy parts, and the hot douche at home, all aided in

accomplishing the result, which at first was no more than to make the patient more comfortable, since her work at the sewing-machine continually aggravated her very annoying condition. Relief was marked when rest was possible, but only a moderate improvement in her condition was accomplished after two months treatment upon alternate days; but this I look upon as very satisfactory, considering the conditions of the treatment, in the face of household labors and the daily machine-work.

CASE XVII. Miss B. S. *Chronic ovaritis*.—Uterus low in the pelvis, anteflexed, anterior displacement of both ovaries, which were sensitive and enlarged, pain especially in the right ovary; excessive suffering during the menstrual period; an increase of pain with the slightest exertion, walking or standing. Active revulsion was first resorted to by faradism, for the relief of backache, and painful tension in the back of the neck. A small plate as positive pole was placed over the most sensitive ovary; the spine was then exposed and brushed sharply with the negative, more intense, pole, up and down with a strong faradic current of high tension, and frequent interruptions for not over a minute; then, the patient being placed upon the operating-table, the same current was used with weaker intensities over the ovary; direct vagino-abdominal faradization for three minutes upon the right ovary, with the small plate as a negative abdominal pole, the cotton-covered ball electrode as the positive vaginal pole against the ovary. Pains and nervous symptoms were thus relieved.

A relapse occurred, following an overexertion, and causing severe pain in the right ovary; to relieve this, galvanic revulsion was tried, applied upon the abdomen directly over the seat of pain, by Dr. Boudet's instantaneous blister or galvanic vesicator, as I might call it; positive and negative poles connected with a metallic plate, consisting of two concentric rings, separated by perhaps an eighth of an inch, the positive pole connected with one, the negative with the other. When applied upon the slightly moistened abdomen it causes smart burning, and blisters the surface as by a chemical cautery. Immediate relief was experienced, and the former condition restored after the second application, two days later, which was followed

by vagino-abdominal faradization. The use of iodoform and iodized-cotton tampons followed each application of electricity. After three week's treatment the condition was decidedly improved, and the menstrual period passed with somewhat less pain. I then resorted to the galvanic current, the negative pole applied to the uterine cavity, negative electro-cauterization, beginning with 40, terminating with 80, milliampères—the dry treatment accompanied this proceeding as before. While a weaker current of 30 to 40 milliampères was used, Sims's uterine probe in the uterine cavity, the large instrument not entering on account of the displacement, the small abdominal plate sufficed; but when an intensity of 60 milliampères had been passed, intense abdominal burning was caused by the use of the small plate as dispersing electrode—as is always the case when currents too strong for proper dispersion are used, i. e., when the dispersing electrode is too small. The larger one—of medium size—was then used, and the same eleven cells, which with the small plate gave an intensity of 60 milliampères with intense abdominal burning, gave 70 milliampères with but slight burning; this, it must be well understood, being always cutaneous—external—no sensation whatever upon the part of the intra-pelvic electrode. I may here remark that an intensity of 60 milliampères, with the small abdominal plate ($3\frac{1}{2}$ by $4\frac{1}{2}$ inches), caused quite a cauterization of the abdomen; the characteristic hard, brownish scab, as if the cutis had been scorched by a red-hot iron, appearing when the patient returned for treatment. The medium-sized electrode sufficed for the use of as high as 90 milliampères, without any unpleasant sensation or effect.* The

* This case is liable to mislead the practitioner who should accurately follow the doses here applied, since this patient was unusually amenable to treatment, bearing without pain high intensities with but moderate dispersion. Larger electrodes are usually required for such currents; as a rule, for the vagino-abdominal application of over 20 milliampères the medium (II) plate must be used, and the large plate for all over 80 milliampères. This is true of the application for other purposes as well—for instance, in cellulitis. A word of caution with regard to the vaginal ball electrode may not be amiss, since intensities over 40 milliampères, when applied for five or eight minutes, in one and the same place, with an electrode only thinly coated with cotton, will cauterize the tissue and burn into the mucosa. If over 40 milliampères is applied, a larger ball electrode should be used, thickly covered with cotton; if not, a *labile* application is the only alternative to avoid vaginal cauterization.

treatment was continued with considerable regularity on alternate days throughout this intermenstrual period, and the next flow came on without pain, more normal in quantity.

These cases are mostly complicated, so that we must take account of the existing conditions and vary the treatment accordingly. For the relief of pain by counter-irritation in chronic ovarian inflammation, we may use either faradic or galvanic revulsion: faradic with a metal brush over the seat of pain, a strong current of high tension; the galvanic with a concentric metal vesicator. Congestion and diffuse pain is best relieved by mild vagino-abdominal faradization with currents of high tension, and in case of induration without excessive pain, mild vagino-abdominal galvanism, the negative ball electrode as the active pole in the vagina, as near as possible to the morbid center, the positive pole as the dispersing electrode, upon the abdomen. The anode may be used for its anæsthetic effect if the sensitive organ is near the surface, within reach of the polar action. The positive pole of the faradic current must always be used upon the painful spot. As a rule 40 milliamperes, more or less, may be employed; but, according to the case, we should use from 20 to 80, rarely 10 or 100, the large ball and large abdominal plate being necessary if the highest intensity is used, the medium plate answering in the main in ordinary cases.

V.

Atresia and stenosis of the uterine canal.

In this I look upon the galvanic current as our main reliance, in preference to any other method of treatment. The results are positive, speedy, and followed, in contradistinction to any other method of treatment, by immediate relief if pain exists, and this is a condition almost invariably accompanied by excessive menstrual suffering, and not unfrequently by more or less continuous pain. The destructive and the electrolytic and absorbent action of the negative pole and negative galvanic current is here called for; the sound, as a metallic electrode

connected with the negative pole, is the active agent, while a large dispersing plate is placed upon the abdomen as the indifferent positive pole. Negative electro-cauterization, 100 milliampères, more or less, in sittings of five minutes, will invariably suffice to accomplish the object. A single treatment before the menstrual period will give relief from the agonizing pain which accompanies these conditions; the treatment continued twice a week, if very strong currents are used once a week, for the course of several months, will result in a cure. Unless peculiar conditions, menorrhagia or metrorrhagia, which are not common in these cases, exist, the metallic negative pole is the active agent. It is the polar action of the anode as a cautery—a destroyer of tissue—and an electrolytic, which we use, as well as the absorbent electrolytic action of the interpolar current, the anelectrotonous, as in hyperplasia for the reduction of the superabundant tissue. In case of complete occlusion, the stylet with the negative pole is gradually pressed into the tissue as it yields before the destructive action of the current. As a rule the canal is permeable to a fine probe, and this is used in the first sitting, the ordinary sound being often passed after a five minutes' treatment; larger instruments are introduced in successive sittings as the enlargement of the canal admits of their use. We may begin with 50 milliampères—in sensitive patients with 15 or 20 milliampères; but 100 is necessary for positive effective action, and we may use as high as 150, even 200, milliampères if it should be necessary for certain reasons. The positive pole should only be used if hemorrhagic conditions co-exist, as it causes too great a destruction of tissue without the active electrolytic effect—that is, the following absorption.

CASE XVIII. *Recent narrowing of the canal after Emmet's operation.*—Mrs. H. called upon me in October, 1886, suffering from dysmenorrhea and uterine pains since the closure of the cervix on account of a deep laceration in June, 1886. I found a very small os, and a narrow canal admitting only the fine Sims's sound. The patient had been treated during my

absence by her attending physician, Dr. Lewis, who had recommended her to me for operation. The dilator had been used quite a number of times, and the dysmenorrhea relieved when treatment was possible directly before menstruation; the dilatation naturally caused pain and gave no permanent relief. The symptoms were eased by the first negative electro-cauterization with only 50 milliamperes. Two days later 80 milliamperes, five minutes; at the third sitting a large sound was introduced, while before a fine probe was used with difficulty, and 100 milliamperes, applied for five minutes. The following menstrual period was much less painful; more free. When she returned the canal had again contracted. Sims's sound was used, and after the fourth treatment Simpson's sound introduced, with 100 milliamperes, for five minutes. This treatment was continued, and the next menstrual period passed without pain, but the canal again narrowed somewhat; after the second month of treatment, ten applications, permanent relief was obtained.

CASE XIX. *Anteflexion, stenosis of the internal os.*—Mrs. — had suffered from intense dysmenorrhea for the past five years; discharge pale and scanty. The patient was treated during my absence in the gynecological department of the polyclinic by my assistant, Dr. Ameiss, who succeeded in introducing a fine probe after ineffectual attempts by others. Negative electro-cauterization, 60 milliamperes, for five minutes. The menstrual period coming on directly thereafter was accompanied by much less pain than usual. Treatment continued during the following month twice a week; a large Simpson sound replaced the fine Sims's, and from 80 to 100 milliamperes were used; a normal menstrual period followed, entirely free from pain, to the great delight and gratification of the sufferer, who expressed herself as feeling like a new being, more comfortable than at any time in the past five years. When I saw the patient, treatment had ceased for a time, and the canal had again somewhat contracted, but immediately after the first application I could introduce a large sound, and since the second treatment this has been constantly used. A third menstrual period is now passed free from pain, and the canal readily admits the large sound.

I may justly claim the use of the galvanic current—the electro-chemical cautery—as the treatment in such cases; not an aid alone, for the relief of symptoms or to assist other agents used, as in some conditions in which I recommend the use of electricity, but the main stay of the surgeon. For the relief of stenosis, acute or chronic, whether of recent date or of years' standing, this method is preferable to all others; it is not only painless, but at once eases, if it does not completely relieve, such pain as may at the time exist. Compare with it other means of treatment; slow or rapid dilatation, the tent, sponge or tupelo, or the steel dilator. The tent is of little use in a very narrow canal, impossible often, and when used causes great pain, necessitates the bed, and results in hardly more than a temporary dilatation; when applied directly before the menstrual period it gives relief, but it must be used steadily for a time, and such treatment confines the patient to bed, and the result is but temporary. Likewise that of the steel dilator, an instrument which causes suffering at the time, and to be effective confines the patient to her bed. The knife gives comparatively favorable results, but this necessitates a small operation, and cicatricial contraction may even do away with all benefit accomplished.

In speaking of electro-cauterization it must be remembered that in this paper I always refer to the chemical cautery, since the actual galvanic cautery is beyond the scope of my investigations. High intensity of the galvanic current gives a chemical cauterization without heat by the metallic negative pole, while the actual galvano cautery, by the heated wire, has a thermic effect, and I advocate in stenosis the use of the negative pole, on account of the electrolytic action, accompanied with much less actual destruction of tissue than would follow the use of the positive pole, and an electrolytic absorbent effect of both pole and current which we do not find on the part of the positive.

VI.

Relief of congestion and the accompanying pain.

In acute cases we utilize the sedative, nerve quieting influence of high-tension faradism for the relief of pain, with mild intensity, and the non-metallic positive, as the active pole; the anelectrotonic action of mild galvanic currents from a non-metallic positive pole likewise serves to quiet the sensory nerves, and reduce the existing irritation, but in addition, by its effect upon the vasomotor tracts or the dilated capillaries direct, seems to cause a contraction, and thus to reduce congestion and inflammation, as we can observe upon cutaneous surfaces. If faradic currents of greater quality and less tension are used, applicable in passive congestion unaccompanied by pain, we obtain the contractile antiphlogistic effect of faradism. Perimetritis we have already discussed. Where more diffuse inflammations are accompanied by congestion, by a succulent, edematous condition of the tissues and pain, mild faradic currents of more or less tension, in direct relation to the intensity of the pain, will afford relief by their sedative action, and permanent benefit by their antiphlogistic effect, the contraction of vessels and tissues.

The remarkable effect of the current thus used is best illustrated by a case of inoperable abdominal tumor, accompanied by peritoneal inflammation and general functional debility, the abdomen being reduced five inches in circumference after the fifth treatment, the edematous condition and pain relieved, functions re-established. I refer here to acute, active, and passive congestion, but as I am not entering in detail into the treatment of the various diseases of the female sexual organs, I have grouped under this head various inflammatory conditions, heterogeneous in their character, with perhaps no other points of resemblance than those of congestion and pain, briefly referring to such as I have not treated of more fully in this paper.

Dysmenorrhœa, often due to pressure upon nerve fila-

ments, occlusion of the canal by inflammatory swelling, acute or chronic, is relieved by no other means as readily; negative electro-cauterization, 10 to 40 milliampères, and utero-abdominal faradism with currents of high tension. The results are immediate, surpassing those of any other agent, equal to a powerful anodine; they are rapid, resulting usually in a sedative action upon the nerves and stimulation of the vascular system. The method of application varies with the case, but if possible an active intra-uterine pole is to be used; where this is not feasible we resort to vagino-abdominal application.

Endometritis, with profuse discharge, yields to positive electro-cauterization of from 50 to 100 milliampères; the flow is diminished, the diseased tissue cauterized, nutrition stimulated. In chronic cases, with induration and little or no discharge, negative electro-cauterization is preferable, and I would add the contractile effect of the faradic current by means of its intra-uterine, bipolar application with currents of low tension and more quality. This is only when pain has been overcome.

For the relief of *membranaceous dysmenorrhea*, likewise, the galvanic current is one of the most effective agents, as in Case X, in which membranaceous dysmenorrhea and menorrhagia, accompanied with perimetritis, occurred. A most striking example is that of a physician's wife who had been married five years, sterile, suffering from membranaceous dysmenorrhea, uterine enlargement and descensus; cavity, wide. She had been treated by the ablest Eastern practitioners without positive benefit, at least not so as to overcome sterility, membranaceous discharge, and dysmenorrheal pain, which yielded finally to the persistent use of the galvanic current with a metallic negative pole in the uterine cavity—negative electro-cauterization. I say persistent use, as this was many years ago, before I had become familiar with the use of high intensities, so that probably but 5 and 10, at most 20, milliampères were used, and the treatment prolonged much beyond the time it would have required

had it been more effectively applied. Complete relief and conception followed.

The treatment of *endometritis fungosa* and *hemorrhagica* by positive electro-cauterization would perhaps come more properly under the treatment of neoplasm. Here the hemostatic effect of the positive pole is desired, as well as the peculiar cauterization produced thereby. Intensities of from 100 to 200 milliampères should be used; treatments once or twice a week, according to the intensity of the current.

VII.

Subinvolution.

I speak here of subinvolution not immediately after labor, but as it comes under the care of the gynecologist in chronic cases. We utilize the intra-uterine (bipolar), galvanic, and faradic currents, unless contra-indications exist, as excessive sensitiveness of the organ, when the treatment is inaugurated by cervico-abdominal applications. The contracting and stimulating effect of the faradic current is desired, hence currents of greater quality and less tension, short secondary coil of thick wire, with interruptions of less frequency are used, applied intra-uterine (bipolar), and cervico-abdominal, where the former is not possible. The galvanic current is of service also, as a mechanical contractor, and when induration accompanies these cases its absorbent properties are utilized, and its sedative action is secured where pain exists; for contraction we resort to the intra-uterine (bipolar) application; for absorption, to negative electro-cauterization of the cavity, using low intensities, from 30 to 40, at most 50, milliampères; rarely to the cauterizing effect and strong contraction of more powerful currents. To overcome subinvolution we must direct our efforts—

1. To promote retrograde metamorphosis, which is furthered by the catalytic action of galvanism, and attained by negative electro-cauterization with from 40 to 80 milliampères.

2. To stimulate muscular contraction, which is effectively accomplished by bipolar intra-uterine galvanism of moderate intensity and bipolar, or utero-abdominal, faradism with currents of quality.

3. To improve the circulation and stimulate functional activity, which necessarily follows the above applications.

CASE XX. Mrs. H. *Hypertrophy, subinvolution after repeated labors, and directly after the removal of a small intramural fibroid.*—Patient experienced no pain, but suffered from most profuse and debilitating menstruation, which could not be controlled by iron, ergot, or the hot douche. I applied bipolar galvanism, in sittings of five minutes every third day for two weeks, followed by utero-abdominal and intra-vaginal faradization by currents of low tension and great quality, four to five hundred interruptions per minute. Bipolar intra-vaginal faradization being used for the purpose of stimulating and contracting the vaginal and pelvic tissue, which had all been relaxed by labors and the traction of a diseased and enlarged uterus.

CASE XXI. Mrs. S. *Subinvolution, retroversion two months after confinement, bearing-down pains, spinal irritation.*—Vagino-abdominal faradization; cervico-spinal faradization, by currents of medium tension and intensity. After three treatments on alternate days, bipolar galvanism was used during two sittings, the discharge lessened, and the uterus diminished in size; it was not so low, and the annoying symptoms were relieved.

The treatment of subinvolution by the electric current is simple, effective, and certain; while this agent is superior to, and should take precedence of, any other, it does not and should not preclude internal medication or local applications.

VIII.

Prolapsus uteri when due to relaxation of tissue.

The electric current serves as a valuable aid in combination with other treatment, and enables us to manage these cases successfully, with a prospect of perfect restoration, a result hardly possible to achieve by former methods, the only

choice being between operative interference and mechanical support. As the operation is but rarely resorted to, the pessary or support is the most common remedy for this affliction, and this relaxes the parts still more, affording temporary relief, but actually disabling the patient, while actual improvement is possible by the method now suggested. The contractile qualities of the faradic current of low tension and greater quality are employed; either medium or heavy wire coil, to contract the muscular fiber, strengthen the vascular coats and stimulate the circulation. Vagino-abdominal and bipolar, intra-vaginal, faradization is here used in connection with the dry treatment, reposition of the uterus and contraction of the tissues by astringent tampons. The stimulating and contractile effect of stronger galvanic currents may serve to assist faradization; and here the shock of making and breaking of the current may be utilized, of course with weak intensities. The mechanical contracting effect of faradic currents of quality and their stimulating properties are mainly to be relied upon. Since we rarely find these cases of prolapsus or descensus uteri uncomplicated, merely due to relaxation of the uterine supports, vagina, and ligaments, but frequently accompanied by, and partially resulting from, a heavy, enlarged uterus, we must first attempt to reduce such hypertrophy, for which purpose negative electro-puncture, with currents of from 80 to 150 milliamperes, and bipolar intra-uterine galvanism, are used, as in hyperplasia; if from subinvolution, then the treatment varies accordingly.

CASE XXII. Mrs. H., aged sixty-four. Suffering from prolapsus uteri, endocervicitis, and deep laceration of the perineum, had been unable to walk any distance for the past thirty years; living in a country town, she was enabled to move about by using a low phaeton. When the patient first came to the city, it was with great effort that she was brought to my office, being obliged to walk half a square from her home to the street-cars, and from the cars to my office. During three months Mrs. H. gave herself up completely to treatment, rest-

ing the greater part of the time during the first two months in the semi-prone position. Negative electro-cauterization was first resorted to to overcome the rather profuse discharge, and to diminish the size of the uterus, from 50 to 80 milliampères being used for four minutes, followed by bipolar intra-vaginal faradization for four minutes, with a current of greater quality, 500 interruptions per minute, which served to contract and strengthen the vaginal tissue. For the same purpose, and the support of the uterus as well, I inserted tampons of tannated cotton coated with a thin layer of ferrated cotton. These were left in place for two days, and removed by me before renewed treatment. After the second week, the discharge being diminished, negative electro-puncture of the uterus with platinum needles was resorted to, 80 to 100 milliampères for four minutes, sittings on alternate days until eight or ten punctures had been made. The uterus was hereby reduced in size. The treatment for the following months was bipolar intra-uterine galvanism, 10 to 20 milliampères for four minutes, followed by vagino-abdominal faradization for three minutes, and bipolar intra-vaginal faradization for three minutes; the vagina was then dusted with an astringent antiseptic powder, and the same astringent tampons used; these were, however, now removed upon the second day, just before returning for treatment, and a hot-alum injection taken. During the third month the patient began to take some exercise, walking a square at a time, until gradually she walked the six squares to my office. Her general condition improved very much; her appetite was much better; the swelling of the left leg, due to edema and venous congestion from pressure of the enlarged, prolapsed uterus upon the pelvic veins, steadily diminished; the pains in the leg, which had been supposed to be rheumatic, became less and less, leg and foot thinner, and for the first time in many years the patient was enabled to wear a shoe, in place of a slipper, upon the left foot, such as the one she wore upon the right. Her walks were extended, the treatment became gradually less frequent, every third day, twice a week, weekly, until, after four months of steady treatment, this lady, who had not walked but a few steps at a time for the past thirty years, was enabled to walk with comfort as far as could be expected for one of her

age and general condition. Her spirits, the tone of her system, were all much improved; she had increased in weight; the swelling of the leg which had existed for years had disappeared, though for several months she continued to use tampons, which she herself inserted. I believe that now she has done away even with these.

This lady, the mother of a physician, had been under treatment so long, had patiently tried so much, with so little benefit, that for years she had given up all hope. Unwillingly she began treatment, and the result, which surpassed my most sanguine expectations, was a striking one.

I have found the electric current, properly used, a valuable aid in the treatment of prolapsus, where surgical interference is not admissible, provided there be some reasonable hope of success, when the perineum is not too seriously injured, and the tissues still retain some contractile power. The weight of the uterus must be reduced before we may expect a result, and an opportunity given the relaxed fibers to contract by a reposition and the holding in place of the organ by mechanical means; the contraction and stimulation of the tissue must be furthered by every possible aid—astrigent medication, the hot douche, and rest in proper position. It is by no means in every case of prolapsus that we may expect benefit; but, where relief by non-operative measures is feasible, the mechanical action of the faradic current, or the interrupted galvanic, greatly aids such treatment and leads to success, where without it all our efforts would be futile.

IX.

The treatment of uterine displacements.

The electric current serves as an aid more or less valuable, according to the existing condition, in the management of the various forms of displacement. Though the current assists in the treatment only, it is one of the most potent elements in what I would call the proper method of treating displacements—the removal of the cause.

The mechanical, contracting and stimulating, action of the faradic current of quality, a short secondary coil of heavy wire, is of service where displacements are due to relaxation of tissues, and must of course be concentrated upon the weak part. The absorbent and nutritive effect of galvanism, vagino-abdominal, is of value where contraction of ligaments and induration of tissues, uterine or cellular, underlie the displacement; here we use negative vagino-abdominal galvanism, the cotton-covered ball electrode as the active negative pole as near as possible to the contracted or indurated tissue in the vagina, the positive pole as a medium or large dispersing plate upon the abdomen. Currents of from 20 to 80 milliampères, according to the resistance of the tissues in individual cases, with the same absorbent, even electrolytic, quality are utilized; when the affection is due to hypertrophy of anterior or posterior wall of the uterus, from 60 to 100 milliampères are used by negative electro-cauterization, as in stenosis, or even by electro-puncture.

The cause must be ascertained, and the displacement treated accordingly. I can not advocate the treatment recommended by some, which appears to me theoretical, who state dogmatically that in anteflexions the ligaments posteriorly must be strengthened and contracted; that one electrode is to be placed in the rectum, the other in the uterus or upon the fundus, and in retro-displacements one electrode is to be placed in the bladder, the other in or against the uterus. If the uterus is anteflexed by reason of the contraction of the anterior ligaments, we must use the absorbent effect of the galvanic current, and possibly a mild stimulating effect of the faradic current upon the posterior ligaments. The stimulating and contractile effect of the faradic current of quality and low tension is admirably adapted to overcome that form of anteversion so frequently found in combination with a slight descensus in women who have borne children, and in whom coition seems to cause the tilting forward of the heavy uterus, which is no longer held by the weakened support. If the retroflexion is due to relaxation of the an-

terior ligaments, these must be stimulated and strengthened by the faradic current. If antelexion be due to hypertrophy of the posterior wall, this must be reduced by the absorbent electrolytic action of a strong galvanic current; if possible, by electro-puncture, a strong needle or small stylet, equal to a No. 1 English catheter, is plunged into the indurated part and connected with the cathode, the anode with the large plate upon the abdomen, and a current of 60 to 100 milliampères is passed for five minutes, more or less. If this is not possible, the cathode is placed on a cotton-covered ball electrode against the part per vaginam, the anode, with the medium or large plate over the fundus, and currents of 20 to 80 or 100 milliampères used for five to eight minutes; care being taken that the negative ball electrode does not cauterize the vagina; hence it must be thickly covered with cotton, and slowly moved from place to place, without causing shock. The posterior ligaments we can reach directly through rectum and uterus or through the rectum and vagina. I would not advise the intra-vesicular placing of the electrode for the purpose of affecting the anterior ligaments, which should be reached through the anterior fornix. I rarely treat a flexion or version with electricity alone, but I very frequently use the current for the correction of displacement in connection with such other treatment as is called for, and I have been well satisfied with the progress and result.

X.

Hemorrhage, metrorrhagia and menorrhagia, when due to neoplasm or relaxation of tissue.

In the non-pregnant uterus we use the hemostatic effect of the metallic positive pole, relying upon this almost altogether, aided, perhaps, by the contractile action of the proper faradic currents; positive electro-cauterization in sittings of from three to six minutes, and intensities of from 50 to 150 milliampères. In case of large uterine fibroids with moderate resistance, from 100 to 200 milliampères may be used.

The positive pole of the galvanic current produces an immediate hemostatic effect, and if the flow be in any way due to relaxation of muscular fiber, this application is followed, when hemorrhage has been checked, by intra-uterine or utero-abdominal faradism, with a current of quality to intensify the contractile action.

In the uterus post-partum and post-abortum, the mechanical action of the faradic current is the most potent agent for the control of hemorrhage.

The polar action is hemostatic direct, by reason of the coagulating effect of the acids accumulated at the anode, the interpolar current stimulates contraction of muscular fibers and vascular coats, when the anelectrotonus is of high intensity. I have already cited several cases incidentally.

CASE XXIII. Bettie Jones, already cited. *Menorrhagia and metrorrhagia*.—Continuing for four months, due to cellulitis with effusion, relieved by a first application, positive electro-cauterization, 80 milliampères, the metrorrhagia at once overcome, the menorrhagia completely checked after treatment during one intermenstrual period; the same application continued, from 80 to 120 milliampères for from five to seven minutes.

CASE XXIV. Mrs. V. (No. 123). *Menorrhagia and metrorrhagia accompanying a fibroid tumor of the uterus, hematocele and cellulitis with effusion*.—Positive electro-cauterization, 60 milliampères for eight minutes; platinum sound in the uterine cavity and large plate on the abdomen. After the first treatment the bleeding, which had been almost constant, stopped. After three treatments the menses appeared almost normal in quantity; positive electro-cauterization was continued, 100 milliampères being used for six minutes, lower intensities, 60 milliampères for eight minutes. (I might again incidentally call attention to the importance of the dispersing plate, 60 milliampères causing a moderate burning with the use of the large dispersing plate, no more than an intensity of 20 milliampères with the small plate, the large plate enabling us to use 100 milliampères without unpleasant burning, notwithstanding the excessively sensitive condition of the abdo-

men. The resistance of tissues and electrodes amounted to 290 ohms.) These most threatening symptoms being relieved, negative vagino-abdominal galvanism was used for purpose of absorption, beginning with 40 milliampères for six minutes, the large plate upon the abdomen, with the positive pole, the cotton-covered ball electrode as the negative pole against the hematocele.

Vagino-abdominal galvanism of from 40 to 60 milliampères was used during the month; positive electro-cauterization, 100 milliampères, being again resorted to as the menstrual period approached. The patient improved, subjected herself to fresh exposure, which resulted in an acute exacerbation, withdrawing her from clinical observation.

Cases of menorrhagia or metrorrhagia due to tumors, to cellulitis, to endometritis fungosa, or hemorrhagica, wherever an undue sanguineous discharge exists, all should be so treated; the metallic positive pole should be used directly upon the diseased surface; this pole being always of non-corrodable metal-platinum or gold, is surrounded at the close of the sitting by a pure white foam, distinguished readily from the pale brown, or yellowish-white, which gathers at the cathode.

XI.

Amenorrhœa.

Amenorrhœa, the total absence or scant appearance of the menstrual flow, has been one of the more difficult conditions to overcome, frequently resisting treatment, or yielding only to the most persevering efforts of the physician. A cause of great anxiety to any woman so afflicted, it is, at the same time, a source of annoyance, an evidence to the physician of his weakness, being a symptom which may arise from a variety of causes, local or general, due to retarded development, to anemia and nervous prostration, to disease of the ovaries, or of the uterus itself, or its lining membrane. We can hardly look to any one remedy, or to any one line of treatment, for relief; if treatment is successful, it

has only been so after persevering efforts, by overcoming the underlying disturbance; hence a variety of remedies, internal and external, treatment local and general, have been resorted to. But in the electric current we have an agent which aids us not only in overcoming most successfully many of the deeper lying causes, but which at the same time serves at once, regardless of actual improvement, to bring about the menstrual flow. We can truly say that it is *the* remedy. While formerly this symptom was one of the most perplexing, it is now, by the aid of the properly-applied galvanic or faradic current, one of the most readily overcome. The hypermanganate of potash, applicable in a limited class of cases, has been the only remedy which directly reached this symptom, and this even is far inferior to the electric current, either in rapidity and certainty of effect, or range of application.

In the majority of cases of amenorrhea, which are at all amenable to treatment, I have found the electric current to be not only reliable but rapid in its action. We utilize the faradic current as a tonic for the nerves and a stimulant for the vascular system, in moderate intensities and with medium tension. The galvanic current serves as a stimulant to the functional activity of the mucous membrane, and we utilize especially the hemorrhagic and fluidifying tendencies of the negative metallic pole, the mild catalytic action, negative vaginal-abdominal galvanism as a pelvic stimulant, or directly applied to the mucosa as a utero-abdominal application with mild currents, 10 to 20 milliampères, and cotton-wrapped applicator (preferable to the metallic sound) in the cavity to dilate the blood-vessels and increase the flow of blood.

The faradic current I have found mainly applicable in amenorrhea, when due to retarded development in young girls, or to nervous or physical prostration; and the metallic negative pole of the galvanic battery in older cases of very scanty menstruation, due to disease of the mucous membrane, or of the muscular tissue of the uterus; the latter seems indicated in case of hyperplasia, chronic metritis and endometritis, stenosis, or uterine fibroids. I have applied the faradic

current for local stimulation to the mucosa direct, bipolar (intra-uterine); and for more general stimulation of uterus and ovaries, from the vagina or uterus to the abdomen (utero-abdominal), and from the uterus to the spinal column, placing either the sound with the negative pole within the uterus or a cup-shaped electrode against the cervix, and the positive pole, a small plate, upon the spine in the lumbar region; general faradization may aid as a tonic to the system. The galvanic current is most effectively applied directly to the mucous membrane, the cotton-wrapped applicator as the negative pole in the cavity, the small abdominal plate over the fundus, if the tissues are not dense, the resistance small, 200 ohms or less; if more, and it may be as high as 600 or 700 ohms, the medium, in rare cases, the large abdominal plates must be used; mild currents for six or eight minutes. Where it is desirable to stimulate the functional activity of the ovary, the negative pole is applied in the shape of the cotton-covered ball electrode as near as possible to that organ, per vaginam, the abdominal plate being placed over the fundus or the region of the ovary. If the tissues offer great resistance, 5 to 10 milliampères will suffice; if used for eight to ten minutes with less resistance, currents of 20 and 30 milliampères are admissible, but for not more than five minutes. In cases of scant menstruation, an effect is visible after a very few treatments, and this I have even repeatedly found to be the case in complete amenorrhœa, although I should hardly say that it is to be expected. According to the nature of the case, the treatment is continued every second or third day, or applied only a few times directly before the appearance of the menstrual period.

CASE XXV. *Amenorrhœa from retarded development.*—Miss J., aged eighteen, a fair, well-developed, and somewhat slender Southern girl, had had her menstrual period but once, five months ago, since its first appearance, almost two years earlier. Though not sickly, she was frail, her eyes weak, her throat delicate, unable to endure either physical exertion or nervous strain. The utero-abdominal faradic current of medium ten-

sion and moderate intensity was applied, the negative as the most irritating and stimulating pole connected with the sound in the uterine cavity, the positive pole for three minutes upon the abdomen, for six minutes upon the spine. This application was repeated two days later, whereupon the menstrual flow appeared. The patient was unable to remain in the city much longer, and received but two more applications. She returned home, and a second healthy menstrual flow came on four weeks after the first; her health improved, but during a hot Southern summer this again failed; the period grew painful, irregular. Returning to the city in the following October, treatment was resumed; the same applications were made, and the existing endometritis and displacement at the same time received attention. While in the city under treatment, the flow appeared regularly, her health improved, and her physique developed, so that upon her return to her home, as her mother wrote me, the girl that went came back a woman.

In the case of Miss X., from B., Case XXXVI, to be mentioned later, the regular appearance of the menstrual flow was brought about by the use of abdomino-spinal and spinal faradization. It being the wish of patient and parents that local uterine treatment be avoided, if possible, external applications were tried, with the most satisfactory result; the morbid symptoms were corrected, the functional activity of the sexual organs was established, and a healthy tone of the system developed.

CASE XXVI. Mrs. G. (No. 91). *Scanty and painful menstruation due to hyperplasia of the uterus and narrowing of the canal, sequences to chronic uterine diseases following laceration.*—A case in which negative electro-cauterization had been used as the proper remedy for the purpose of dilating the canal, reducing hyperplasia and relieving the accompanying pain, at the same time increasing the flow; all but the latter was accomplished. The canal was enlarged, pain in head and side relieved, but the scantiness of the discharge was in no wise altered. Before the next menstrual period, utero-abdominal faradization was resorted to, and after two applications

of six minutes each the menses appeared stronger, for a longer period of time, and of more natural color. Gynecological treatment was continued, and, for a week previous to the period, faradism was applied every other day with satisfactory results. The case is peculiar, since negative electro-cauterization, usually so effective in these conditions, failed signally to increase the flow, while faradism gave an immediate result, possibly on account of its stimulating influence after the local disease had been improved by galvanism.

CASE XXVII. *Scanty menstruation due to uterine hyperplasia.*—Suffering from painful and scanty menstruation for the past five years, since the birth of her first child; laceration of cervix and perineum; indurated, enlarged uterus, with thickening and induration of the mucous membrane, narrowing of the canal, menstrual flow very scanty and extremely painful. Galvanic current used, negative electro-cauterization, negative metallic pole in the uterine cavity, abdominal plate over the painful left ovarian region; current of 30 milliamperes for four minutes; after the second application, two days later 60 milliamperes were used to gain also an electrolytic action (on account of the narrowing of the canal). The menstrual period appeared more free, accompanied by much less pain. The treatment was continued, as high as 100 milliamperes being used, and a perfect result achieved, the next menstruation being normal in character, free, lasting five days, without pain of any kind.

This was one of those striking results: rapid and complete relief from intense suffering, which had continued so long that the patient had accepted the condition as inevitable, and she could hardly realize the sudden change, doubting her own identity. A stronger current was used for the purpose of enlarging the canal and overcoming the hyperplasia. The treatment not being directed against the amenorrhea primarily, I cite the case rather as an example of the hemorrhagic tendencies of the negative pole.

In that class of cases where other treatment is almost futile, the electric current may be relied upon for these almost magic effects.

CASE XXVIII. Mrs. K. *Scant menstruation, fibro-myoma of the uterus, filling the pelvic cavity, extending to the umbilicus.*—Fibroid reduced by electro-puncture, profuse hemorrhage repeatedly following the treatment when high intensities were used; menstruation, which was always extremely scant, was hardly bettered by the treatment employed for reduction of the fibroid, and as the patient looked forward anxiously to the establishment of this function, negative electro-cauterization was resorted to, platinum sound in utero, large plate on abdomen, 240 ohms resistance, 120 milliampères for five minutes. The flow, which appeared after the third application (every second day), was more profuse. This treatment was then continued, and the period following was normal in character, lasting five days—better, she says, than any she has had for years. The treatment being somewhat neglected, the following period was not quite as free, but thoroughly re-established upon again resorting to a few applications of higher intensities.

I would here call attention to the fact that, in the case of scanty menstruation due to neoplasms, the high intensities should be tried, since the electrolytic effect upon the growth, which is the most important object in view, demands this, and I have repeatedly seen that, by an improvement in the condition of the organ, the menstrual function was established, though currents of 10 and 20 milliampères from non-metallic electrodes would, I believe, act with greater certainty upon the menstrual function.

XII.

Hystero-neuroses.

For the speedy relief of many of the annoying reflex symptoms which accompany uterine disease, the galvanic current is the remedy above all others to be employed. We have no agent which equals it, and in the wonderful relief given lies, as I have already stated, one of the greatest dangers which accompanies the use of electricity; if any result follows, it is complete, and even instantaneous. Freed from

suffering, the patient believes herself to be well, and acts accordingly; increased exertion or exposure at once brings about that exacerbation of symptoms, a lighting up of slumbering fires, which we so often find in chronic pelvic disease after any slight indiscretion, against which the patient is guarded while cautioned by her pains; but free from these, she no longer thinks of the underlying disease which has practically not been in any way bettered by the single application, though it has dispelled all suffering as if by magic.

The electric current is the only agent which so rapidly overcomes the neuroses accompanying uterine disease, which are frequently of more importance in the eyes of the patient than the causative morbid condition; hence the value of electricity in gynecological treatment, even when not used for the relief of the local condition, as an aid to such applications as may be made; but where electricity is used for the treatment of the disease itself it serves a secondary, but to the patient far more important, purpose—that of relieving her from distressing symptoms. These hystero-neuroses vary so greatly that it is hardly possible to define either kind or intensity of current to be used; but, as a rule, such currents should be resorted to as will at the same time benefit the existing pelvic disease.

CASE XXIX. MRS. H. *Laceration of cervix, hystero-neuroses.*—Suffering from intense pain in the head and back of the neck, insomnia, spinal and lumbar pains, palpitation of the heart, with shortness of breath upon exertion; the result of laceration of the cervix and accompanying troubles, subinvolution, descensus uteri, endometritis. The patient had been under treatment for five weeks preparatory to an operation upon the cervix. Decided local improvement was evident, but her general condition was but little bettered; she could walk but a square or two without resting, on account of the bearing-down pain, backache, palpitation, which were especially marked when she attempted to ascend a flight of stairs, which was impossible without resting a few times to take breath. I resorted

to negative electro-puncture of the uterus with the platinum needle, to reduce the enlargement, using 60 milliampères; from this she felt more relief than she had by all the previous gynecological treatment. Two days later the application was repeated, 90 milliampères being used; and as I removed the electrode, she exclaimed, "Now I am relieved; I am all right." The usual precautions were taken until the following day, but then she took a good walk, and upon the third day attended a ball in a public hall, on the third floor of the building, hastening up-stairs in advance of her party, and, when at the head of the stairs, turned about to cheer them on—a remarkable change from her previous debility; formerly she had been completely out of breath, unable to speak after slowly ascending a few steps; and that evening, for the first time in years, she danced a little. Until the time of the operation, patient felt perfectly well, free from any of the former suffering. No gastric annoyance; neither spinal or lumbar pain; sleeping extremely well.

CASE XXX. Mrs. I. (No. 110). *Hystero-neuroses*.—A case similar to the last. Laceration of the cervix, subinvolution, supra-pubic and lumbar pains; physical weakness and nervous debility. Some improvement in the local condition had been achieved by three weeks' ordinary gynecological treatment, but her suffering had been but little bettered. Utero-abdominal faradization was resorted to; currents of medium tension and intensity; though immediately after the application she felt dizzy and excessively faint in the stomach, her pains disappeared after the second sitting; even the discharge was lessened; she was certainly rendered comfortable, and this relief was accomplished by two applications of the faradic current, while she had been little bettered in relation to these neuroses by the three weeks of ordinary treatment preceding.

CASE XXXI. Mrs. A. (No. 102). *Annoying neuroses*. *Laceration, subinvolution, endometritis fungosa, profuse mucopurulent and hemorrhagic discharge*.—The patient had been under treatment, but not improving as I wished her to, the galvanic current was resorted to, negative electro-cauterization of the uterine cavity, 60 milliampères, five minutes; platinum sound within the uterus, large plate upon the abdomen. After the first application the local condition was decidedly improved

and her suffering relieved, so that she stated that she had not felt so well at any time since the birth of that child which had produced the troubles from which she now suffered.

CASE XXXII. Mrs. S. (No. 29). *Anteflexion, endocervicitis, chronic cellulitis, annoying neuroses.*—Suffering from extremely debilitating voluptuous dreams, which had begun soon after her marriage, and which had haunted her and weakened her so that she had in vain sought relief during the past five years, having even been abroad at various watering-places and consulted celebrated physicians. This seemed a case well suited for the electric current, and I at once resorted to negative electro-cauterization to uterine cavity, 30 milliampères, with vagino-abdominal faradization. Some improvement was apparent after the second treatment; after the sixth treatment (every other day) the restlessness was overcome; she slept well, and her very great terror, the dreams, have ceased. She is better than she has been at any time during the five years since her trouble began, according to her statement. An attack of malaria coming on, treatment ceased and the patient returned to homeopathy, fearful of possible doses of quinine. The dreaded nervous symptoms returned, though with less intensity, and as patient did not return for regular treatment, an application every few months was only possible—yet this afforded some relief.

CASE XXXIII. Mrs. B. (No. 109). *Weakness, nervous prostration after Emmett's operation.*—Identical with one I have since had. Desiring to leave the hospital two weeks after the operation, she was prevented from doing so by great weakness. She came into the operating-room with a dragging step, low-spirited, faint. Negative electro-cauterization, 50 milliampères, for five minutes, was applied to the uterine cavity for the purpose of relieving the slight discharge, followed by vagino-abdominal faradization, five minutes, as a stimulant. After a single application the depressing symptoms ceased; two days later the treatment was repeated. She left the hospital, promising to return if not completely relieved. I saw her but once since, and she was in the best of health, in fact, immediately after the first treatment she expressed herself as feeling perfectly well.

I relate this case as an example of a large class in which electricity is eminently serviceable for the purpose of stimulating the nervous system, and aiding it in recovering its tone from that depression which often follows operations upon the pelvic viscera, and for the immediate dispersing of the annoying symptoms for which uterine operations are often undertaken, but which yield but slowly to continued care without this agent.

CASE XXXIV. Mrs. C. *Gastric and mammary hysteroneurosis*.—Suffering from chronic metritis with endometritis; excessive menstrual pain, accompanied by swelling of the left breast and distention of the stomach, with low anterior position of the anteflexed uterus; came to me in an exhausted condition, and discouraged by years of unsuccessful treatment by various physicians.

The flexion was acute, the canal narrowed, and the uterine walls thickened and hard. No attention was paid to the neuroses, though severe, and the treatment directed at once to the relief of the endometritis, flexion, and hyperplasia, to which I ascribed the debility and distress. Negative electro-cauterization of the endometrium was first attempted November 8th, 30 milliampères for six minutes; fine copper-probe in the cavity; medium plate over the fundus; in addition, iodoform and elastic-supporting tampons were inserted. November 10th, the same treatment was repeated, 50 milliampères being used, the probe entering with less effort. November 13th, 80 milliampères were well borne; the flexion was diminished, and the canal widened so that I could introduce the ordinary uterine sound, though with a considerable curve. November 15th, I applied 120 milliampères, with the ordinary sound and normal curve. On the evening of the following day the menstrual period came on, more free and without the pains in breast and stomach which had previously accompanied the flow. The swelling of the breast was slight, likewise the distention of the stomach, which had existed so long; as a precaution, she remained in bed, but felt quite well. The menstrual neuroses, which had haunted her for years, so that the approach of the period was looked for with such anxiety as to make life miserable, were relieved by four applications. The treatment was

continued, and during the next period, which appeared after an interval of three weeks of persistent attention, ten applications, I was unable to keep the patient in bed, as she experienced so little discomfort. The supporting tampons were continued, ten-per-cent nitric acid was used as an alterative to the endometrium, and intra-uterine and vagino-abdominal faradization was used at a later stage, after the eighth application of the metallic cathode with intensities varying between 80 and 120 milliampères. After the third period, bipolar, intra-uterine galvanism was substituted for electro-cauterization, and intensities of 20 and 30 milliampères were used as alterative and stimulant. The neuroses which were so readily relieved by the first four applications completely disappeared with prolonged treatment.

Certain of these neuroses we may attempt to relieve directly, and I will here speak of the treatment which is applicable to such pains, whatever may be their cause. The gastric and thoracic neuroses, nausea, palpitation of the heart, difficult or rapidity of breathing, may be relieved by the application of galvanism to the pneumogastric; very effective in many cases, as I have found. A cotton-covered ball electrode is placed upon the right pneumogastric, at the lower border, in the corner of the sterno-cleido mastoid muscle, the other pole being in the uterine cavity in case of gynecological treatment, if not, upon the pit of the stomach or in the hand; a current of from 3 to 8 milliampères being used for three minutes; and for three minutes the second pole is placed upon the left pneumogastric, in a site corresponding to that of the right, a treatment which should be repeated daily until relief is obtained, and which is of service in some cases of nausea during pregnancy, when not due to local cause.

In case of gastric or hypogastric symptoms, if counter-irritation is indicated, galvanic vesication, by the bipolar method, may be used, or the large abdominal plate connected with the positive pole may be placed over the uterine fundus, and a small metallic electrode or metal brush used in con-

nection with the negative pole over the seat of trouble; 10 to 20 milliampères, when used with the bare metallic plate, two inches in diameter, for purposes of revulsion, cause sharp burning.

In case of spinal irritation we have no better method than faradic revulsion; the repeated stroking of the spine with a metallic brush, the faradic current of high tension and intensity being used; the indifferent pole is a large plate which is placed either over the uterine fundus or over the lowest portion of the spine.

I will here discuss the treatment of neurosthenia and pruritus vulvæ, which may be classed among the hystero-neuroses, at least such forms as come under the care of the gynecologist, since they are neuroses resulting from uterine diseases.

NEUROSTHENIA.—General faradization, and spinal or utero-spinal galvanism with medium non-metallic electrodes is indicated. These cases of nervous debility which come under the eyes of the gynecologist result from pelvic disturbance, and while proper means are being used for the relief of the existing disease, the electric current should always be applied, if possible, in some way to aid in the treatment direct, as a uterine or vagino-abdominal application, especially for the purpose of stimulating the sympathetic and the pelvic nerves. Should electricity not be applicable in the management of the existing pelvic disease, it should be used as the most effective means of overcoming these neurotic symptoms, and for this purpose the stimulating effect of a faradic current of moderate or even high tension is best; moreover, the metallic brush, or diffuse, interpolar faradization of the muscles over the entire body, is an aid to massage or other treatment that may be employed.

PRURITUS VULVÆ.—The galvanic current should receive a trial when relief does not follow the use of other means in this persistent affliction. The sedative effect of the non-metallic positive pole with mild currents is indicated. I have used it with most remarkable success in several cases. In one the relief was so striking that it deserves mention.

CASE XXXV. Mrs. K. (No. 20). *Eczema marginatum, pruritus vulvæ*.—The patient came under treatment December 2, having suffered for six years, ever since the appearance of the menopause, since which time she has been more or less constantly under treatment; for months at times in the hospital; eased now and then, but never relieved; the apparent cause of the annoying pruritus was a profuse discharge from a partially prolapsed uterus. The dry treatment, bismuth and plain tampons in vagina and vulva, were used with success, and the patient left completely cured in February. March 1st she returned with aggravated itching, all symptoms again appearing with increased severity after a cold from wet feet. Neither the former treatment nor any other relieved the ugly and annoying eczema, which covered a space the size of an ordinary sheet of note paper on either side of the vulva. The local condition as well as the suffering of the patient increased, notwithstanding all efforts, and on May 12th the galvanic current was used. Cotton-covered metal ball electrodes were used, with from 4 to 6 milliamperes, the poles being moved about within the surface affected, remaining for perhaps half a minute in one place. At the point of any excoriation excessive burning was caused. This application was made May 12th. On May 14th, when the patient returned, she was improved beyond recognition; the itching had entirely disappeared; she had slept throughout the night, the time during which her suffering was most agonizing before, and the ugly, deep-red surface, covered by heavy patches of the size of a nickel, was now smooth, with the exception of one single light blotch, which was of a pale-brown color and smooth. This treatment was continued on alternate days, and on May 21st she was again discharged, the skin normal, with the exception of a few thin scabs.

XIII.

Chorea and other nervous disturbances accompanying puberty and the menopause.

A condition which perhaps deserves especial mention no more than other of the hystero-neuroses, yet it is one which is so liable to resist other methods of treatment that the use

of the electric current, which is one of the most important agents for treatment, must be considered. We should use the current as far as possible for the relief of the causative local condition, and where this is either not possible or ineffective, it should be used for the treatment direct. We rely greatly on the sedative action of the anelectrotonus on the motor and sensory tracts, and on the local polar effect—the blistering action of the metallic pole with the galvanic current—the revulsive action of the metallic brush with the faradic, sharp, strong currents for a short time, the interpolar and extrapolar current serving as a sedative in some cases, as a stimulant to the nervous system in others.

CASE XXXVI. *Chorea accompanying the period of development.*—Miss X., from B., a tall girl of fourteen, in the period of development; the menstrual period had appeared twice at irregular intervals; scant; she suffered from mental depression and chorea; incomplete control of muscles of the tongue and the right side; speech interrupted; almost impossible under excitement; sinking spells at times; at others choking sensations. Examination and local treatment to be avoided if possible.

A faradic current of high tension and moderate intensity was used, the small plate being applied above the pubes, and the small metallic electrode to the throat for five minutes; spinal revulsion with the faradic brush, high intensity, followed this application for one minute more, the brush being passed rapidly down the spinal column. Tonics were given, and in the course of two months' treatment the girl was completely cured; the menstrual function fully established; her general appearance greatly improved; a youngest child and pet, she was restored in complete health to her anxious parents, who had in vain sought relief since the beginning of this annoying trouble during the preceding four months, the symptoms at times being so severe as to simulate complete paralysis; the most violent spasmodic contractions and fainting spells coming on at others.

CASE XXXVII. *Fainting spells, gastric and cardiac disturbance, insomnia at the time of the menopause.*—Mrs. C.,

forty-five years of age ; mother of three children ; had never been strong since the birth of her second child, fifteen years before, but had not suffered sufficiently to seek assistance. The enlarged, indurated and anteverted uterus caused traction on the ligaments, pressure by the cervix upon the rectum, by the fundus upon the bladder ; menstruation was profuse and very irregular, the pelvic pains, however, were insignificant compared to the peripheral nervous disturbance. The following treatment was inaugurated : Positive electro-cauterization of the uterus, 50 to 80 milliampères, five minutes, to check the flow and improve the local condition ; astringent applications were also made to the cavity, and tampons used to replace and support the uterus. A weak galvanic current, 3 milliampères, was applied to the pneumogastric, the negative pole upon the nerve of the right side, the positive in the uterine cavity ; and for an equal space of time the negative pole was placed in the shape of the cotton-covered electrode upon the left pneumogastric. Bromide of potassium and tonics were given. The symptoms were relieved after the second application, and gradually subsided after the fifth week of continuous treatment on alternate days.

In these cases it is impossible to define a method of treatment ; the symptoms must be met ; but, as a rule, in chorea resulting from uterine disturbance, utero-spinal or abdomino-spinal applications should accompany other treatment.

XIV.

Rectal disease ; hemorrhoids ; prolapse of the rectum, constipation due to inactivity of the muscular coats or dilatation of the rectum.

In these cases we utilize the contractile and stimulating effect of the faradic current of quality and low tension, the short coil of heavy wire, using the current proper, the interpoler as well as the extra-polar current. The positive pole of the galvanic current, applied with the non-metallic electrode to the part direct, serves with mild intensities as a sedative, a stimulant, and contractor of the vascular coats,

less reliance being placed on the effect of the pole, the polar action proper.

HEMORRHOIDS.—In case of smaller hemorrhoidal tumors, as in thickening or prolapse of the membrane, I have used recto-abdominal galvanism, the positive ball electrode firmly pressed against the part to be affected either within or without the rectum, a medium-sized or large plate upon the abdomen as the dispersing negative electrode; according to patient and condition, currents of from 6 to 30 milliampères may be used. Larger hemorrhoidal tumors are treated by positive electro-puncture with the platinum needle. It is one of the few cases in which we use the positive pole in electro-puncture, but it is here desirable on account of its coagulating and destructive effect. In small hemorrhoidal tumors I have used currents of 30 to 40 milliampères with admirable result, and I shall test the treatment in larger tumors, the puncture being made with several needles at the same time.

In case of *prolapse of the rectum* with congestion of the tissue, painful evacuation, the reposition of the part by the ball electrode, covered with a thin layer of absorbent cotton, and the use of a galvanic current of from 10 to 30 milliampères, has a most excellent effect. I have seen complete relief from all the annoying symptoms follow a few applications; visible improvement in the local condition followed prolonged treatment, aided by astringents. In a case of prolapse with relaxation of the tissue, consequent upon laceration of the recto-vaginal septum, in which defecation was excessively painful and annoying, as if through vagina and rectum both, walking being painful and impossible to any extent, recto-abdominal galvanism, 20 milliampères, for five minutes, afforded relief, and after the second application the patient seemed completely free from this annoying affection, which had continued for the past five years. Returning for treatment, she told me that during the afternoon following the sitting she had experienced a continuous burning, but upon awaking the next morning she hardly realized her own condition, as for the past five years she had never been so

comfortable; she was more free from pain, able to walk without interference, defecation, as she expressed it, "had never been so healthy and natural since girlhood." The local appearances were but little changed; the prolapse was less marked; the congestion was diminished; the edematous thickening was reduced; the color less bright; constipation resulting from relaxation was diminished.

Galvanism may be used for the purpose of reducing such local congestion as may exist; but the faradic current of quality and low tension is indicated in constipation with relaxation; a small plate, three by four inches, as the indifferent negative abdominal pole, is placed upon any point over the track of the colon, while a cotton-covered ball electrode is moved along the mucous surface of the relaxed rectum; better still, the rectum and lower portion of the colon is filled with lukewarm water, the current being imparted by the metallic rubber-covered rectal tube, the water serving to disperse the current over the entire inner wall of the rectum. These applications, combined with external abdominal faradization and tonic medication, are our most effective means of overcoming chronic constipation from atony of the bowel. Dilatation of the rectum is treated by intra-rectal, bipolar faradization and by the same recto-abdominal application. The relief from chronic constipation, a frequent accompaniment of uterine disease, is one of the secondary and accidental results following gynecological electro-therapeutics, and it was the repeated observation of this effect which induced me to apply the current directly for this purpose, and I now look upon it as the most rational method of treatment for certain forms of constipation.

XV.

Painful or difficult micturition due to spasmodic contraction or relaxation, to irritability of the urethral tissues, or hypertrophy of the membrane.

An intra-urethral or urethro-abdominal current may be used in this trouble—the galvanic to relieve and relax, the

faradic to stimulate and contract. If galvanic, the non-metallic positive pole should be in the urethra, thoroughly insulated up to the point of attack; from 3 to 8 milliampères may be used. If faradic, it is applied in the same way, but a mild current of high tension must be used. Relief has been obtained in many cases. If the vesical affection be of central origin, we resort to galvanization of the nerve-trunks. In spasmodic conditions the sedative positive pole is placed upon the lower part of the spine, the negative dispersing pole over the bladder; and in debility, the negative, as the active pole, over the nerve-center. Spasmodic contractions of local origin are treated by anelectrotonic action of mild currents from non-metallic electrodes to the affected part, if possible, a cotton-wrapped applicator in the urethra, the urine or water injected in the bladder serving to conduct the current to that organ from the metallic pole, which is insulated to within one inch of the end, so as not to come in contact with the urethra or vesical tissue.

Relaxation, resulting in incontinence when in the sphincter, in retention when in the detrusor, is treated by the catelectrotonic action of galvanism—the negative non-metallic pole in contact with the muscle, the positive dispersing pole over the fundus—or by a similarly applied faradic current.

Galvanic vesication, or irritation by the faradic brush, may serve as a counter-irritant in painful and in inflammatory conditions, and general faradization from spine to bladder as a stimulant; but, if possible, the localized polar action is preferable.

Congestion of the urethral mucosa and hyperesthesia is overcome by mild currents, 2 to 4 or 6 milliampères, from the positive pole of the galvanic current. The result of the treatment is foreshadowed by the result of the first application; some beneficial effect should be at once observed; but if the pain or difficulty be increased, some error has been made in the application, or an idiosyncrasy exists, which debars us from further attempts in this direction.

THE GALVANIC AND FARADIC CURRENTS IN OBSTETRIC PRACTICE.

In obstetrics we have few conditions in which electricity is of such service that it can not be replaced by other more convenient remedies. It is mainly valuable in subinvolution and extra-uterine pregnancy; it is extremely effective, but by no means superior to other means, in uterine inertia and post-partum hemorrhage. I have used it also in case of weakness and irregularity of labor-pains, and in paralysis of urethra and bladder. As I have already stated, for the purpose of inaugurating premature labor, although probably effective, I do not consider it a proper agent unless uterine inertia accompanies the condition.

The difficulties which oppose the introduction of electricity into active obstetric practice are such that it will never become popular, and, in truth, is only feasible in lying-in institutions.

I. UTERINE INERTIA.—In uterine inertia during and after labor I have used the mechanical contractile action of the faradic current, with secondary coil of thick wire, applied intra-uterine (bipolar), if possible; if not, utero-abdominal or utero-spinal. As a nerve stimulant, bipolar intra-uterine or utero-spinal galvanism is preferable. The intensity of the current varies with the needs of the case; in a case of complete inertia, due to inanition in consequence of excessive vomiting, where absolute relaxation existed, not a single fiber contracting, I have succeeded in carrying on the labor by utero-abdominal faradization alone. In case of mere weakness of labor-pains, milder currents have succeeded admirably; but these I must say I have used only for the sake of experiment, though with perfect success. In one case only, that of absolute inertia consequent upon inanition, was the current thoroughly indicated; and here it was, in fact, the only possible method of carrying on the labor. Ergot had been tried by hypodermic injection; hot and cold applications, varied, to the abdomen, friction, and massage were used, all in vain; the uterus responded only to the faradic current.

The course of nature was simulated as nearly as possible, and a contraction caused by a strong current for one minute; the strength was then reduced for a short time and again increased, the uterus responding perfectly to the intensity of the current. The labor was so furthered, after the dilatation of the os by Barnes's dilator, until it was possible to use the forceps, and after the removal of the child the same process was continued for expulsion of the placenta and contraction post-partum.

The properly applied faradic current is an excellent stimulant to nerve and muscle, a most satisfactory remedy, since it acts instantaneously. The obstetrician can vary the intensity or method of application in accordance with the effect which appears during the sitting; he need not wait for possible results, no time is lost. The stomach is not affected, nor does the condition of the stomach in any way affect the result, as is the case with ergot. One objection, the only and a serious one, is the impracticability of carrying a battery about.

II. WEAKNESS AND IRREGULARITY OF LABOR PAINS.—

This is often due to nervous conditions, and utero-spinal or utero-abdominal galvanism, a large positive plate over the fundus, will serve admirably to relieve the suffering caused; if the faradic current is used it should be of medium quality and intensity.

Painful, ineffective contractions, which may render the first stage of labor so tedious and wearing, may be remedied by the sedative and stimulating action of electricity so applied; but we obtain most satisfactory results by the use of ipecac, Dover's powder, a morphine injection, or a chloroform inhalation. I merely mention this condition as one in which the current can be applied, not by any means urging its use, as it is more troublesome and not more effective than the remedies ordinarily used.

III. POST-PARTUM HEMORRHAGE.—

Strong utero-abdominal faradic currents, with a secondary coil of large wire, quality and low tension, or the positive metallic pole of the galvanic battery in the uterine cavity with interrupted cur-

rents, are potent means for checking this dangerous condition; here only can we use the interrupted galvanic current, which serves more especially to contract the muscular fiber, while the positive metallic pole of the galvanic current acts as a hemostatic in the contracted uterus, by its chemical action and by stimulation of the muscular coats of the vessels; if interrupted constant current be used, we have a contractile effect upon the muscular fiber, similar to that of the faradic current, stimulating to the nervous system at the same time. I may say that in the above-mentioned case of complete inertia of the uterus, not more than a few drops of blood were lost by reason of the powerful contraction brought about after expulsion of the child, and likewise after removal of the placenta. In post-partum hemorrhage due to nervous prostration, and complete indolence and absence of all reaction, I have used both the interrupted galvanic and faradic currents with the most perfect success. The effect is certain and rapid, under the hand of the operator; and the action is more natural than that of any other remedy, entirely independent of the condition of the patient, state of stomach, or nerve centers, localized, clear, aseptic. Were it not for the inconvenience of transportation, the electric current, which is theoretically the correct remedy, would soon be practically acknowledged.

IV. IMPERFECT INVOLUTION.—When due to relaxation of the muscular fibers, bipolar intra-uterine or utero-abdominal faradization, few interruptions, high intensities, quality and low tension of current, will invariably produce the desired effect; but galvanism similarly applied is preferable if the condition is accompanied by or due to nerve weakness. For subinvolution after labor or miscarriage, this is an effective and certain method of treatment. The character of the faradic current is the same as in all previous obstetric conditions; the effect desired being similar, a powerful contraction of the muscular fibre, but the application is less severe and of longer duration, such violent action not being called for. When accompanied by hemorrhagic discharge, by weakness of the

nervous system, the galvanic current is to be preferred, the metallic ball electrode connected with the positive pole in the uterine cavity, with the negative pole as the large dispersing plate upon the fundus uteri; 40 to 60 and even 80 milliamperes, five-minute sittings, every other day. For the purpose of relieving hemorrhage, the constant current is most effective; if contraction be mainly desired, this must be interrupted or the faradic used.

In subinvolution, accompanied by mal-nutrition or weakness of the stomach, which we do not desire to burden with medicines, the electric current is unquestionably the most effective agent, and at certain periods should be used in preference to all other remedies, together with the hot intra-uterine douche.

Imperfect involution, relaxation of the abdominal walls, is prevented by this treatment. Better than the binder for the preservation of the figure and the thorough contraction of the abdominal walls is abdominal faradization, with a labile current of quality and low tension, applied with small non-metallic electrodes, moved along the fibers of the various abdominal muscles.

V. PARALYSIS OF URETHRA AND BLADDER.—Not infrequently occurring after labor; causing much annoyance to the patient, and to the physician as well, if he live at a distance; may be met successfully by vagino-abdominal or urethro- and vesico-vaginal faradization, currents of medium tension and intensity. The application is either made when the bladder is moderately full, or two ounces of lukewarm water are injected, and the electrode, insulated up to within a quarter or half an inch of the end, is introduced into the bladder, the surrounding fluid serving to communicate the current to the muscular walls. If the urethra is affected, we may use vagino-abdominal faradization, passing the vaginal electrode along the course of the urethra, or urethro-abdominal galvanism, using a current of from 2 to 8 milliamperes, applied by the metallic electrode to the urethral canal direct. This weakness of urethra and bladder, unless due to pressure,

is well met by the stimulating influence of galvanism, and the stimulating and contracting action of faradism. The desired result may be relied upon if the tissues have not been too severely bruised and injured.

VI. EXTRA-UTERINE PREGNANCY.—The beneficial effects of electricity in this dangerous condition are too well known to necessitate discussion, and I refer especially to the admirable work of Garrigues, who, by his wonderful results, has relieved this unfortunate accident of the almost uniformly fatal results which it was wont to cause. Since I have myself had no experience in the treatment, I can do no more than state that vagino-abdominal faradization or galvanism is to be resorted to; also negative electro-puncture per vaginam. The electrolytic action of the negative pole of the galvanic current is used, and the contractile effect of faradic currents of quality, destroying life and producing retrograde metamorphoses by its effect on vascular coats and vaso-motor nerves, cutting off the blood-supply, which can be done far more effectually than in neoplasm, in which nutrition is directly furnished by large vessels.

Electricity has rendered the prognosis more favorable in extra-uterine pregnancy, since the knife, from which much was hoped, has signally failed.

VII. The contractile, mechanical action of the faradic current may be resorted to for the purpose of checking a galactorrhœa, and its stimulating powers to develop and increase the flow of milk, which is also furthered by galvanism as a nervine and vascular tonic.

In explanation, I must add that the intensities used in the cases here cited have been higher than it will often be found convenient to apply, since I have sought to use currents as strong as possible. Certain intensities are necessary to accomplish a given purpose, but these vary within limits determined by the severity of the condition, the resistance of the tissues, and the nervous and electric status of the patient.

The dosage given may not appear perfect in all cases, since I have desisted from what appeared a useless repetition

of always mentioning size of electrode and time of treatment, which may be inferred; when the time is not given the sitting was of five minutes' duration, and the dispersing electrode, small, medium, or large, varies with the intensity of the current.

The resistance of these plates is small, and that of tissues and electrodes varies in gynecological electro-therapeutics from 60 to 700 ohms, averaging from 200 to 300 ohms; it is not often recorded, since I have no rheostat in connection with my clinic battery; however, in a given class of cases, the intensity possible varies rather with the individuality of the patient, since the resistance is about the same; and as treatment progresses, the current may be increased without giving greater pain.

In order that I may not be misunderstood, as deeming the galvanometer alone necessary for the determination of the dose, I will state plainly, what may be seen from my case histories, what I deem necessary for the correct recording of electrical dosage and treatment:

1. Location of electrodes, by which the electrical sensibility and conductivity, as well as the resistance of the tissues, may be approximated.

For dosage of the galvanic current:

2. Intensity of the current in milliampères.
3. Resistance of the tissues and electrode in ohms.
4. Time of sitting to determine the quantity of electricity used as expressed in coulombs.
5. The size of the electrodes used, by which the density of the current in various parts may be computed, of importance only in interpolar applications.

6. Kind of electrode, by which the chemical effect is determined.

For dosage of the faradic current:

- 2'. Intensity of the current in degrees of the scale (of value only for the individual battery).

- 3'. Tension and quality of the current as determined by the secondary helix.

4.' Number and duration of interruptions.

5.' Kind and size of electrodes.

Before closing, I must refer to some points overlooked in the mass of new material which I have been obliged to classify, condense, and study, and which has continued to accumulate during the writing of this paper.

1. I wish to emphasize the statement, which may not have been clearly made, that *salt is to be avoided* in all careful work, and with the sponge electrode, the salt solution is done away with.

I have mentioned the fact that the addition of salt to the water used for moistening the electrode greatly increases their conducting powers of, but omitted to state that this is admissible only with the sponge electrode, if great resistance is to be overcome; but, as I condemn the sponge electrode, I condemn the salt solution, as unnecessary with the electrode I recommend, and even injurious, as the electrolytic action of the galvanic current decomposes the fluid, and thus causes increased burning, pain to the patient, and injury to the instrument.

Electrodes should be moistened with warm water.

2. I must call especial attention to a most happy secondary effect which frequently follows pelvic electro-therapeutics—that is the yielding of chronic constipation.

Many of the applications are so made that a large electrode is placed upon the abdomen, instead of the faradic, or a stronger galvanic current is used; a stimulation of the muscular tissues by the extrapolar current results; the muscular coats of the intestinal tract, as well as the abdominal muscle, are strengthened and stimulated to contraction; the circulation is improved, and complete relief from persistent and agonizing constipation, which has resisted all treatment, is not an uncommon sequence to the use of electricity in diseases of the female sexual organs.

3. The use of Apostoli's concentric uterine cautery, for the treatment of erosions, ulcerations, or granulations, I have omitted to mention, as many other details have been neg-

lected, yet it deserves notice, and is to be recommended in cases in which a chemical cautery is in place. It is far preferable to the use of acids, fluids, since it can be strictly localized, the effect concentrated upon the proper place, and limited to that. With an intensity of 20, 30, at most 40 milli-ampères, the surface is charred without excessive pain.

I deem it preferable to the acids in most instances, upon the cervical or other tissue, when its application is possible.

4. The very peculiar fact which I have mentioned, that in electrolytic treatment of fibroids the burning pain caused by the dispersing electrode upon the abdomen decreases, while the intensity of the current increases for a time after the maximum number of cells has been attained, may lead to some misunderstanding, since I neglected to add that this is the case only when the abdominal electrode is connected with the positive pole, as is always the case in electrolysis.

This peculiar phenomenon, the decrease of pain with increase of current, and all factors in *statu quo*, is due to the anæsthetic effect of the anode, and not, as I at one time believed and so stated, to the lessening of friction as the passage of the current is thoroughly established. Yet I can not entirely yield a certain faith in this theory, since the burning caused by the dispersing plate upon the abdomen, when in connection with the negative pole, though not diminished, does not increase with the increased intensity after the desired number of cells has been connected.

The electric current may now be considered as a necessary factor in gynecological therapeutics, as a method of treatment but not as a remedy; as one remedy not to be applied in certain cases, as we would iodine, not for certain disorders, but as a method from which the desired factor is to be chosen. I have endeavored to show that in the galvanic and faradic current we possess a variety of effective agents, any one of which is to be utilized as we would utilize any remedy of the pharmacopœia, when called for by existing symptoms. Electricity as such is never indicated, but it is

the contractile or hemostatic action of the anode with high intensities, or the absorbent action of the cathode, which is serviceable, the one in subinvolution, the other in hyperplasia.

In the electric current we possess a great variety of effective agents, which must be applied, like other remedies, under certain well-defined indications, and precisely like all remedies they are but fickle handmaids, effective in one case, they fail in another; but for such failure the method as a whole must not be condemned, nor even the application which has failed. We do not throw aside the iodide of potash because it has proved inefficient in an individual case of syphilis, or because it has produced an eruption; we change the method of administration, vary the dose or the combination, guided by the result in the individual case; so we do with the electric current, varying the intensity or method of application in individual cases, though guided by a standard which is deduced from a great many, ceasing if injurious effects appear, but no longer condemning the remedy because the result hoped for has not been accomplished in a given case; all remedies vary in their action. While electro-therapeutics as a method of treatment is useful and effective, we must not expect invariable success any more than we do from internal medication, which is and will remain an established system, though in individual cases belladonna may fail to act as it was expected to, and morphine will continue to be used as an anodyne, though it may cause violent excitement in certain cases.

Electricity is not a specific, it is not what enthusiasts may have hoped, and yet a potent and effective remedy when judiciously applied.

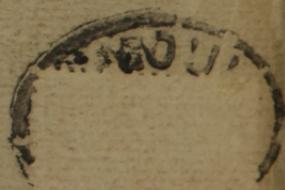
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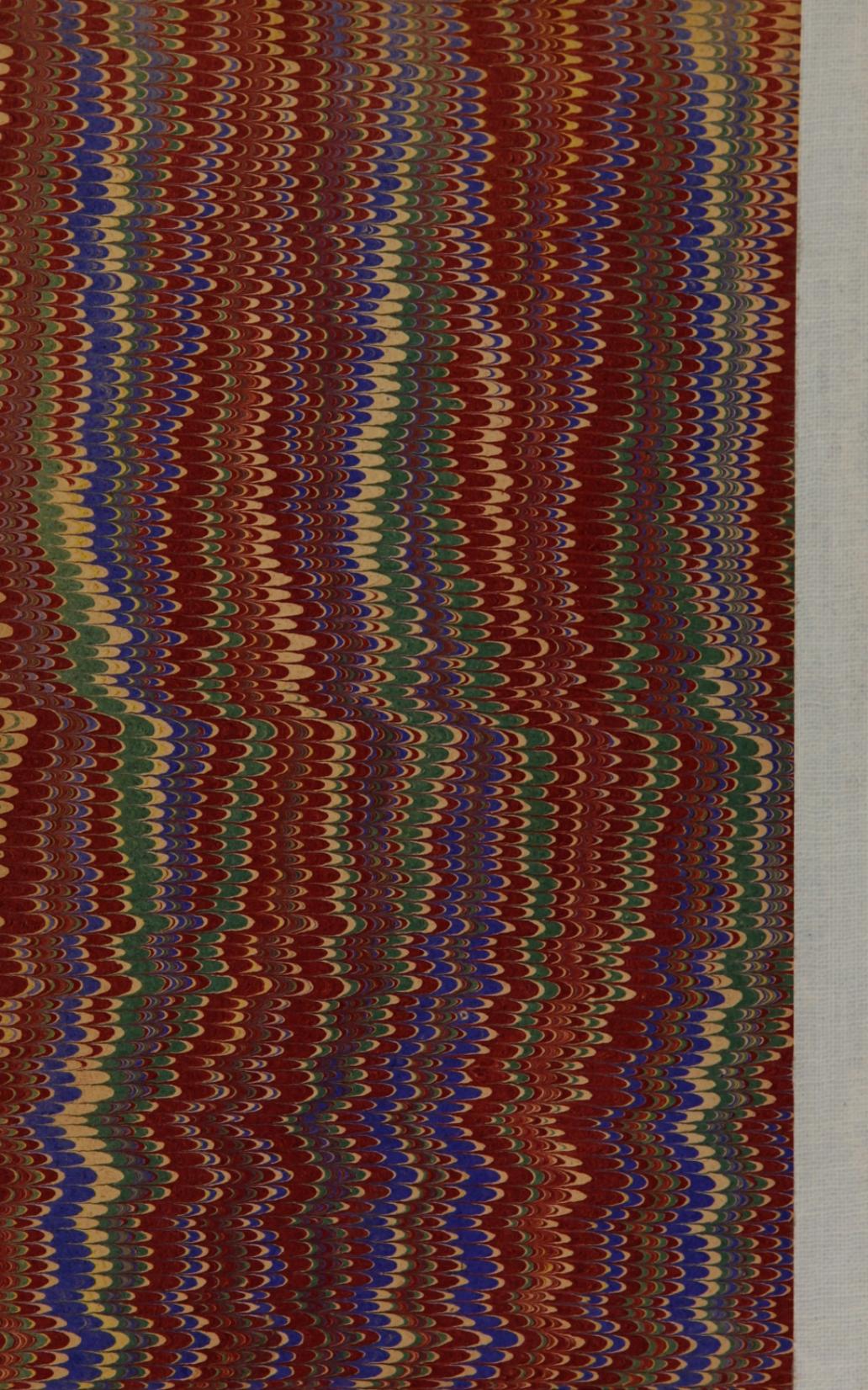
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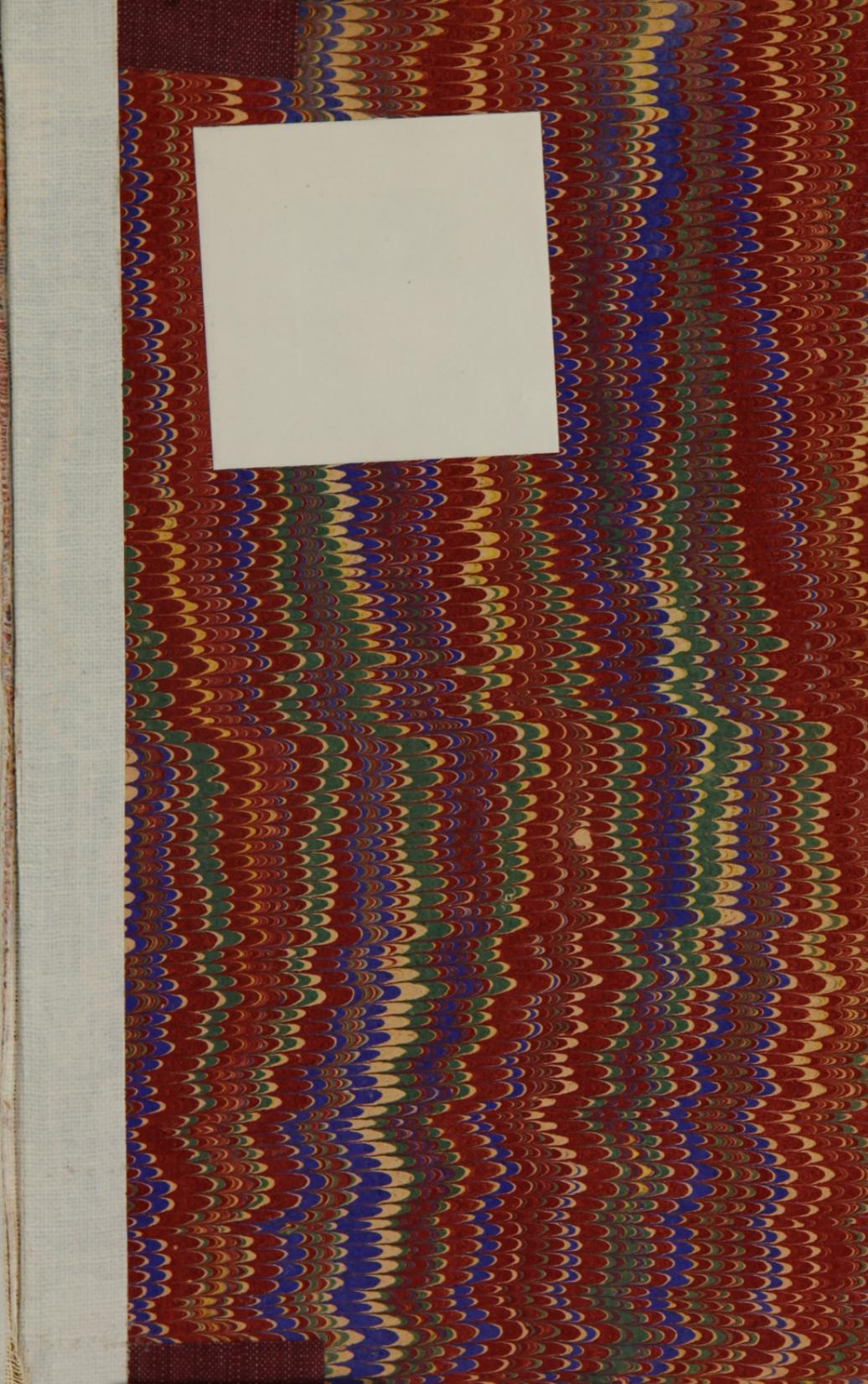
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